
Fest
Gebunden 2c
Gebunden 2c

Gift of
J. H. Pasley Esq.
to the
Jersey Mechanics Institute

see Medical pamphlet at end of vol.

P/B. Steam

Ballooning

&c.

End:

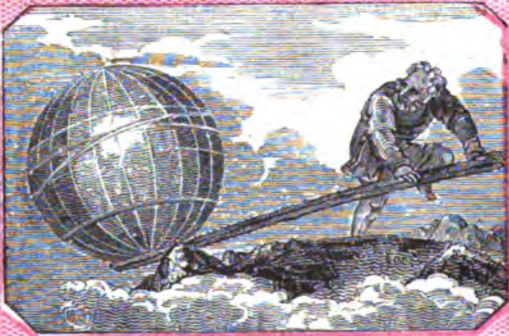
De Foe

MECHANIC'S Magazine.

VOL. II.

KNIGHT & LACEY, LONDON.

MDCCCXXIV.



MECHANICS'

MAGAZINE.

VOLUME SECOND.

"THE MOST VALUABLE GIFT WHICH THE HAND OF SCIENCE HAS EVER YET OFFERED TO THE ARTISAN."—*Dr. Birkbeck.*

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PREFACE

TO

VOLUME SECOND.

THE cordial reception which the Mechanic's Magazine experienced on its first appearance, from the class of readers to whom it is more particularly addressed, as well as from the public at large, and the nearly unrivalled circulation into which it almost immediately sprung, were events of so unusual a nature in the history of periodical literature, that we were willing to think they could only be ascribed to the "extreme desire which prevailed for something of the kind, however imperfect or faulty might be the manner of its execution" (Preface to Vol. I.) We felt sensible that we were indebted for the extensive support with which it was honoured, less to what we had been able to accomplish in our earlier numbers for the benefit of the working classes, than to a generous confidence in our professed determination to spare no exertion to make it, in the end, in every way worthy of its good fortune.

How far we have advanced to this desirable point during our second half-year's labours, it scarcely becomes us to say; but if we may draw a conclusion in our favour from an undiminished and increasing circulation, and from a great accession of valuable and approving correspondents, our course must have been neither without improvement without promise.

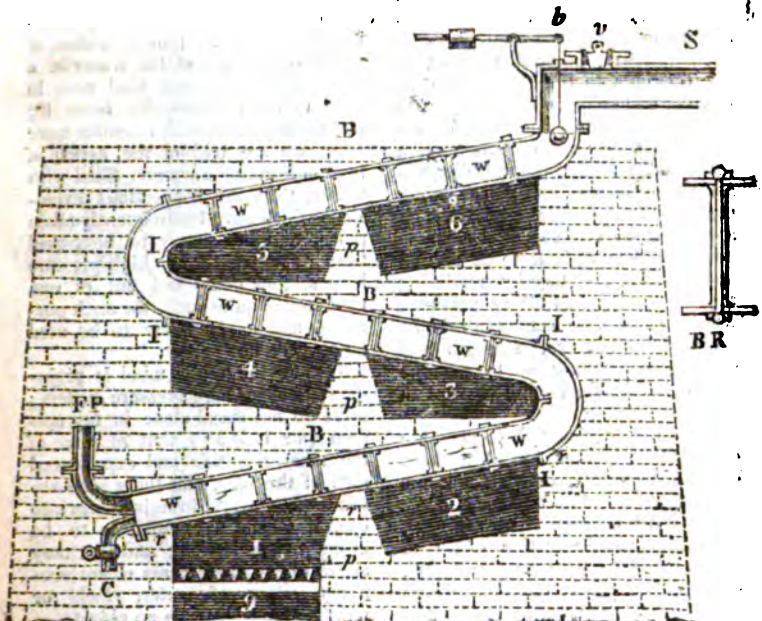
To the several able and intelligent contributors who have assisted to speed our little bark in its onward path, we tender our most grateful acknowledgments. And to the many for whose favours we have not yet found a place, we have to join with our thanks a request, that they will extend a lenient consideration to the motives which have led to their postponement or rejection. It has been all along a chief object of our work to encourage communications from intelligent practical men, and in our selections from those with which we have been favoured, as well as in the order of these selections, we have made it our study to be no further critical, than a regard to the edification of our readers at large indispensably required.

29th September, 1824.

Mechanic's Magazine,
Museum, Register, Journal, & Gazette.

Even the lower orders of men have particular callings in life wherein they ought to acquire a just degree of skill, and this is not to be done well without thinking and reasoning about them.—*Dr. Watts.*

No. 29.] SATURDAY, MARCH 13, 1824. [Price 3d



NEW STEAM-ENGINE BOILER.

plaskynaston, Feb. 8, 1824.

GENTLEMEN ;—Conceiving, as I before hinted, that the future improvement of the steam-engine, especially for the purposes of navigation, depends, in a great measure, on the proper construction of the boiler, and the application of fuel, so as to produce the greatest effect, I make no apology for attempting to add my humble mite to the general mass of accumulating information on this subject, hoping it may prove an inducement to much abler men to lay open their stores of engineering and mechanical knowledge, and to spend a few of their leisure hours in what may truly be called the best service of their country.

Herewith you will receive a plan, section, and description of my newly invented boiler for the propagation of steam, which I promised you in my last, and which I lay before the public, with a confidence that it will be found practically useful, substantially durable, and conveniently applicable to steam-engines of every description.

It is a matter pretty generally understood, that heat is transmissible to water in no other way so well as from below, and that so trifling is the effect downward and sideways, that it is scarcely worth taking into calculation. This well-known fact, together with the accidental discovery made by one of our engine-tenders some years ago, that in high-pressure boilers very little steam-room is necessary for an engine kept constantly at work, and reflecting also on the common trick too often practised, to the ruin of the fire-flued *sides* of many a good boiler of the old construction, namely, working with a very small quantity of water, whenever, from neglect or necessity, steam was wanted in a hurry, or in extra quantity, induced me to turn my thoughts to the formation of a boiler, embracing, in the smallest compass, all the advantages of exposing a thin sheet of water on a broad and wide flat bottom, immediately *over* the fire, and of conveying the latter in flues *underneath*, in such a manner as not to allow a single useful particle of heat to be carried up the chimney, thereby rendering the fuel available as far as possible; at the same time combining in its material and make, strength and security so manifest as to put the fear of explosion completely out of the question.

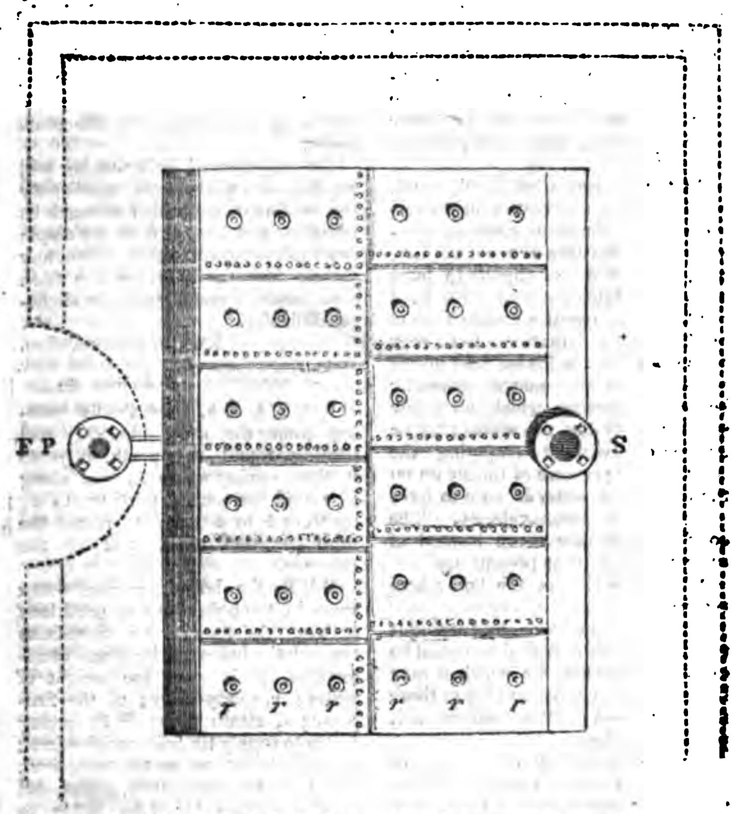
Had not accident betrayed the complete inutility of having a great quantity of steam in store (as is the case with all the unwieldy dome boilers of the old fashion now in use), a moment's consideration ought to have made it known; for if an engine, constantly at work, require a certain quantity of steam each minute, it is perfectly evident, that steam to the full amount of the quantity wanted, must be regularly generated, otherwise the engine would stop, as a few strokes would exhaust the store-room; and in these great boilers the serious loss from condensation is what few persons have a just notion of.

The smaller the steam-room in a boiler, the safer that boiler becomes, though the expansive force of the steam tending to burst or rend it asunder, remains exactly the same: it is the *accumulated quantity* of the explosive vapour which renders it dangerous, if highly heated, not its quality.

I conceive a company of ladies on board a steam-vessel would observe a small nut-shell full of gunpowder put near the cabin-stove without imagining their lives in the slightest danger, should it explode; but were a whole barrel of the same kind of powder placed in that situation, they would then indeed have just cause for the fears they might entertain or express. Thus, by a parity of reasoning, the quantity of a nut-shell full of highly rarefied steam, occupying a space as thin as a sheet of paper, on the top of the water in a boiler of the strongest kind now in use, might undoubtedly burst it; but the rupture would resemble more what we are told of the action of frost in bursting a cannon filled with water, than the tremendous explosions which have too frequently taken place, and are justly to be feared from the cast-iron high-pressure boilers, now going fast out of use. Cast iron is quite unfit for such purposes, and ought never to be used on any account.

I know the public mind is prejudiced against high pressure boilers; but I do not stand alone in my opinion (for it is also that of some of the most scientific and experienced men of the age), that there is an absolute necessity, of bringing them into use, if steam navigation is to be brought to perfection; and that they are of utility in all cases where economy either of water, fuel, or weight of machinery is an object.

Before entering on a description of my Improved High-Pressure Safety-Boiler, I beg leave to observe, that the principle is applicable to any *flat* shape, and that the form represented in the drawings was merely selected by me as the most eligible for the use of steam-vessels, being made in three compartments, joined at the angles or bends, so as to form one boiler, of any determinate length and breadth, having a free communication of water from the bottom to the top, through the whole distance, the fire being made to act by means of flues, on the under side, so as to generate steam all the way up; and as the thickness or stratum of water exposed to its action, is no where more than *six inches* (which space might, perhaps, be reduced with advantage to three inches,



or even less than that) I think I have approached as near a minimum in the economy of fuel as will ever be introduced into general practice.

The divisions above mentioned may be formed of the best wrought-iron plates, riveted together in the usual way, so as to form the top, bottom, sides, &c. of each compartment, each division being in fact a flat boiler, in shape like a bound book, six inches deep, and of the necessary length and width.

To give this boiler a power of resisting the expansion of steam to the utmost extent, as many rivet bolts should be passed from side to side, *quite through* the boiler, as the case may require; and to prevent the upper and lower sides of each division being drawn together in the act of riveting the bolts in question, each should be passed through a tube of cast or wrought iron, inserted inside the boiler, between the plates to receive it; which tube will not only enable the boiler-maker to close each rivet-bolt firm and tight, and prevent the red-hot bolt from bending while the operation is going forward, but afterwards prove a great security against either end of it being drawn through the plates by the excessive pressure of steam to which they may be subjected. The number or frequency of these rivet-bolts will of course vary, as I stated before, according to the strength required; but I calculate that a boiler constructed of good plates, half an inch thick, and bolted in the manner described, so as to allow each bolt (of ½ of an inch round iron) to secure 36 square inches, top and bottom, would require a pressure of steam of more than 1,000 lb. against each square inch to burst it, provided fire can be brought to exert its influence in producing steam of sufficient power to do so, which would be a matter of some difficulty, unless urged by a powerful blast.

As the accumulation of salt, sand, and mud, in the boilers of steam-engines used for the purpose of navigation, is productive of serious injury, by causing the fire rapidly to burn away the plates covered with it, I beg leave to suggest a simple plan of getting rid of such matters. Let a cock be inserted, at the lowest part of the boiler, where such matter generally settles, by opening which, for a few seconds every day, the whole may be drawn off without emptying the boiler, as the pressure of the steam on the top of the water is sure to force all out with great velocity. The cock may likewise serve instead of the common plug at present used.

When one side of the boiler here recommended has been worn as long as may be deemed safe, by turning it top downwards a fresh side would be exposed to the fire, by which it may be made to last twice as long as those now in use—a great advantage, if it possess no other.

As the operation of scaling, or scurfing is, I find, not much attended to, and perhaps not often required in boilers of steam-vessels, the mode I propose of washing out and cleaning the safety-boiler is, by having two or three screw plug-holes in the end of each compartment, in front of the boiler, through which a powerful stream of cold water may be injected from a common garden-engine, and directed among the little pillars in every direction, so as to wash down to the cock before mentioned any salt or mud which might settle in the upper parts of it.

Should it be adopted for steam-vessels, three sides, formed like the boiler, might be substituted for the external masonry, which, by interposing a thin body of water every where between the fire and timbers of the vessel, would render both crew and passengers perfectly safe, both as to fire and explosion, which is the great end I have in view. The water heated in these sides, if not likely to produce steam of sufficient strength, may nevertheless become useful in preparing feed water for the main boiler.

The experienced boiler-maker will see I have endeavoured to simplify the making of my boiler as much as possible; and I hope, from the ample descriptions and directions given, any person desirous of giving it a trial, may construct one without the slightest difficulty.

Ex. Pickering, Jun.

Description of the Drawings.

1, 2, 3, 4, 5, 6, flues, the fire passing from the grate along 1, and turning round the partition *p* to 2, thence going up to 3, and along it, round the second partition to 4; up from 4 to 5 along it, round the third partition to 6, and up the chimney.

B B B, the boiler; *w w w*, water space in the boiler; *p p p*, partitions between the flues; *r r r*, rivet-bolts through the boiler; *b*, buoy and counterpoise, to indicate the weight of water; *v*, safety-valve; *g*, the fire-grate; *s*, steam pipe; F P, forcing pump to supply the boiler with water; C, cock to let out water, salt, mud, &c. R B, rivet-bolt, tube, plates, and *countersunk washer* (the latter to prevent the riveted end of the bolt giving way, or being drawn through the plate), drawn to a larger scale; I I I, rivet joints, by which the compartments are connected together, and the boiler finished; the joint inside the boiler of course to be riveted first, and then the bend-piece put on.

ANALYSIS OF THE SCIENTIFIC JOURNALS.

(Continued regularly.)

London Journal of Arts and Sciences, *No.* XXXIX. *for March*, 1824.

We observe with pleasure a considerable improvement in the *original* department of this work; but in an especial manner we have to congratulate its respectable editor on the sudden yet happy conversion of sentiment which he appears to have undergone with respect to the utility of the London Mechanics' Institution. It is but very lately that we had occasion to refute a most preposterous attack made upon the Institution by one of Mr. Newton's correspondents (p. 372); nor was that the only instance in which it had been unkindly dealt with in the pages of the London Journal. Now, however, we find that the Institution, which in Mr. Newton's last Number was described as *an entire failure*, is in the present considered as an *organized body*, and is honoured, not only with his best wishes for its success, but the assurance of his "most cordial support"! Not the least remarkable circumstance attending this change is the curious fact, that the Institution, after all, turns out to be merely the accomplishment of *part* of a plan promulgated by the London Journal itself, a short while ago, and which, says Mr. N. "it is *gratifying* to find has been *so soon taken up*, and prosecuted *with so much promptitude*" ! ! ! We know of nothing which can at all match this in point of modest assurance; but as a matter of fact we can mention one thing which may possibly cope with it—namely, that the individuals who *so soon took up* (as it seems) this project of the London Journal, and who prosecuted it *with so much promptitude*, never, till this moment, had the smallest conception that they or the mechanics of London owed the London Journal aught but FORGIVENESS for its *uniform* and *zealous* endeavours (until success made proselytism *beneficial*) to *discountenance*, *depreciate*, and *defeat*, the design of the London Mechanics' Institution.

That we may not be supposed to have praised *ironically* the improvement in the *original* department of Mr. Newton's publication (expensive *necessarily*, since talents and acquirements of the degree here exhibited are not to be met with at every corner), we add one or two extracts

ON PORTABLE GAS-LAMPS.

"There is no danger to be apprehended from the explosion of portable gas-lamps, while the *compression* (*ex-pression* rather) of the contained gas is greater than the external pressure of the atmospheric air;" (atmosphere), p. 141.

But, "as the resistance of the contained gas decreases, the external air will gradually gain admission into the body of the lamp. Did this not take place, A VACUUM would be formed," p. 142.—Nay, start not, reader; for though we are first told that a vacuum *would be formed*, we are in the very next words informed, that "it is obviously impossible" ! ! ! p. 142.

"The atmospheric air THEN so entering, and combining with the gas contained in the lamp, *may* form an *explosive mixture*; and *if*, under these circumstances, should another light pass near it, an explosion would appear to be inevitable," p. 142.—Great virtue in an *if!* How is the light, though it "pass near," to penetrate through the sides of the lamp?

Speaking of the portable gas-lamps used at the London Mechanics' Institution, the editor says, "A stop-cock at the lower part of the stem regulated the passage of the gas, which (the stop-cock, or the gas?) was so extremely troublesome, from *the elasticity* (elasticity!) of the gas within the ball *gradually diminishing* as it *became consumed*, that," &c. p. 144. Rare confusion of ideas! Things described as *elastic*, which have only the power of expansion! ! ! Things *diminishing* as they are *consumed* ! ! !

"As all the lamps *went out* BEFORE they *had burned* two hours, it is probable that they had not been sufficiently charged; this might arise from *precaution*, as their form, and the situations in which they were placed, rendered them very *likely* (liable) to be overturned by accident, and *falling* (had they fallen) from the considerable height at which they were stationed (they) would probably have *so much bruised the vessel containing the compressed gas* (been so much bruised) as to have *caused it to open* (burst open), and with the expansive force of thirty atmospheres (the explosion) might have been attended with very serious consequences"—*Editorial Remark*, p. 144.

With due submission to this learned editor (whose bad writing might be excused were there any thing to compensate for it), he has helped to disgrace his pages with a great deal of rank nonsense on the subject of *the portable gas-lamp;* and the sooner he bids adieu to the subject the better. In this very Number, while he talks so gravely of the danger from "the expansive force of *thirty* atmospheres," he quotes (unconscious, possibly, of its bearing) the overwhelming fact, that Mr. Perkins has just constructed a steam generator, "which has been proved to sustain the enormous and incredible pressure of TWENTY THOUSAND POUNDS UPON EVERY INCH OF ITS SURFACE"!!! p. 148.

MECHANICS' INSTITUTION AT NEWCASTLE-UPON-TYNE.

At a Public Meeting held on the 26th ult. it was resolved to establish, under the title of "The Literary, Scientific, and Mechanical Institution of Newcastle-upon-Tyne," an institution calculated to place a knowledge of the arts and sciences, and of literature in general, "within the reach of the humblest individuals in the community." Mr. George Stephenson, engineer, who contested with Sir Humphrey Davy the honour of having invented the safety lamp, and who has risen to eminence by the unaided force of his own talents, was called to the chair; and the movers and seconders of the resolutions were (as their worthy chairman once was) mostly all of the operative classes—carpenters, masons, printers, &c. The report of the proceedings which we have perused in the *Tyne Mercury* is altogether extremely gratifying. The good sense and good feeling which seconded the speeches delivered on the occasion, promise the happiest results. We doubt not that the establishment of the Institution will prove, as one of the speakers predicted, "a new era in the moral history of Newcastle."

May we hope that the name of this Institution is not irrevocably fixed? A Literary, Scientific, and *Mechanical* Institution sounds queerly; the sense in which the word is here used is unusual; and we should like, besides, that the mechanics of Great Britain, acting in brotherly concert, would abide by the simple title of "Mechanics' Institution," as, beyond all others, distinctive and clear.

CUBE ROOT.

London, March 9, 1824.

GENTLEMEN;—I observe in your last Number a few remarks upon the use of logarithms, and on my reply to the question in your former Number on the best method of obtaining the cube root of a given number.

I am not much disposed to enter into a controversy with your correspondents J. T. and J. Y., being of opinion that in proportion to the investigation of the subject, so will be the preference given to the use of logarithms, over every other method, when expedition is desired, with such a degree of accuracy as will be deemed sufficient by all practical men, and I think I might have ventured to have stated, without much risk of being refuted, that in nine instances out of ten, the twelve-inch sliding rule, which is simply a scale of logarithms, will be found fully sufficient for the common purposes of extracting the square and cube roots of numbers, and that by simple inspection.

It was not my intention to say that no cases occur where more than four or five figures may be required; but this I might have said, that when a greater number of figures are required, they may be obtained by a small additional operation, with the aid of logarithms, sufficient to satisfy every case of real practice.

Your correspondent inquires where logarithms may be found to twenty figures of natural numbers? I am not able to inform him, nor do I know the real utility of such high numbers. The common tables of Gardener and Hutton are carried to five figures of natural numbers, and are very easily extended to two more, and the logarithms are given to seven figures.

I should be glad to learn what cases of real practice occur, in which the root, or power of any number, to a sufficient degree of accuracy cannot easily be obtained by logarithms?

I can readily admit, that some hypothetical and theoretic calculations may require more than seven figures, and also that there may be an occasional error in the tables; but it is well known that the errors are few, and easily detected by any person acquainted with the subject, by taking the differences between the proposed number and the adjoining numbers.

Your correspondent will possibly admit, that long and complicated calculations, even by common arithmetic, *are occasionally liable to error*.

It may be expected that I should explain the reason why I adopted the number 287500 instead of some other numbers: so far as I can now recollect the reason, it was to show, that in matters of *real practice*, the first four figures are the most essential, and that the remaining two are of but little comparative importance; another reason might be, that of having at the time of writing the paper no other tables at hand but Didot's stereotype pocket-edition: the example given was explanatory of the manner of using the tables, and not as a proof of the number of figures to which the answer could be carried. If Hutton's tables had been at hand, I might possibly have selected the number 288888, the logarithm of which is 6·4607307, ⅓ of which is 2·1535769, answering to the number 142·422, the root nearly.

I also beg leave to observe, that any inaccuracies which may have crept into my former or the present paper, may in part be ascribed to their being written in a public and crowded coffee-house.

I am, Gentlemen, yours, &c.

B. Bevan.

CONTRIBUTION TO THE HISTORY OF PERPETUAL MOTION.

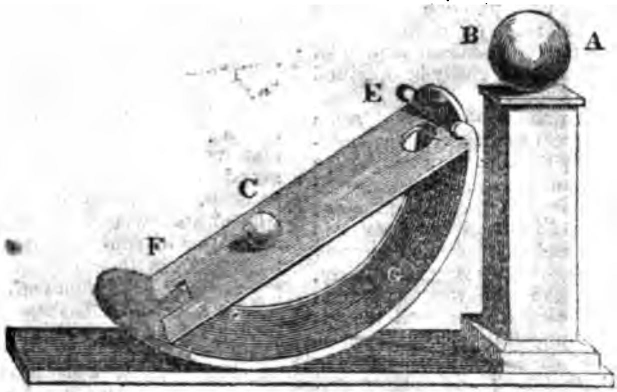
Grange-street, Bermondsey, Feb. 15, 1824.

Gentlemen;—I have often, with no small share of regret, witnessed the attempts of the "visionary" to find out a machine fit to be denominated a "Perpetual Motion," and I am inclined to think that a vast deal of study, expense, and vexation may in future be saved to the ingenious but misled mechanic, by putting him in possession of a knowledge of the labours and bitter disappointments of our ancestors, in their endeavours to get at this "forbidden fruit."

In a treatise by Bishop Wilkins (which I have now before me), entitled "Dædalus on Mechanical Motions," there are several attempts of this kind mentioned, and some very ingenious reasoning on them, and I think that he with great justice applies the appellation which he says some one spoke wittily concerning the philosopher's stone, namely, that it is "*casta meretrix*" (a chaste wanton), "*quia multos invitat, neminem admittit*" (because she allures many, but gratifies none).

One of the attempts mentioned in that work (with the exception of water being used instead of mercury), very nearly resembles that of your correspondent "Philo-Mechanicus" (page 361), and therefore, if it is not trespassing too much on the limits of your very useful Magazine, I will trouble you with the two following designs, and descriptions of them, verbatim, which I think may save some future tyro the trouble of *re-inventing* them. You will, no doubt, perceive that it is the last which I refer to as so much like that of "Philo-Mechanicus."

1st. "But amongst *all these kind of inventions, that is most likely* wherein a loadstone is so disposed, that it shall draw unto it, on an inclined plane, a bullet of steel, which steel, as it ascends near the loadstone, may be so contrived as to fall down through some hole in the plane, and so to return unto the place from whence it first began to move, and being there, the loadstone will again attract it upwards, till, coming to this hole, it will fall down again; and so the motion shall be perpetual, as may be more easily perceivable by this figure—



"Suppose the loadstone to be represented at A B, which, though it have not strength enough to attract the bullet C directly from the ground, yet may do it by the help of the plane E F: now, when the bullet is come to the top of this plane, its own gravity (which is supposed to exceed the strength of the loadstone, will make it fall into that hole at E, and the force it receives in this fall will carry it with such a violence unto the other end of this arch, that it will open the passage which is there made for it, and by its return will again shut it; so that the bullet (as at the first) is in the same place whence it was attracted, and consequently *must move perpetually*."

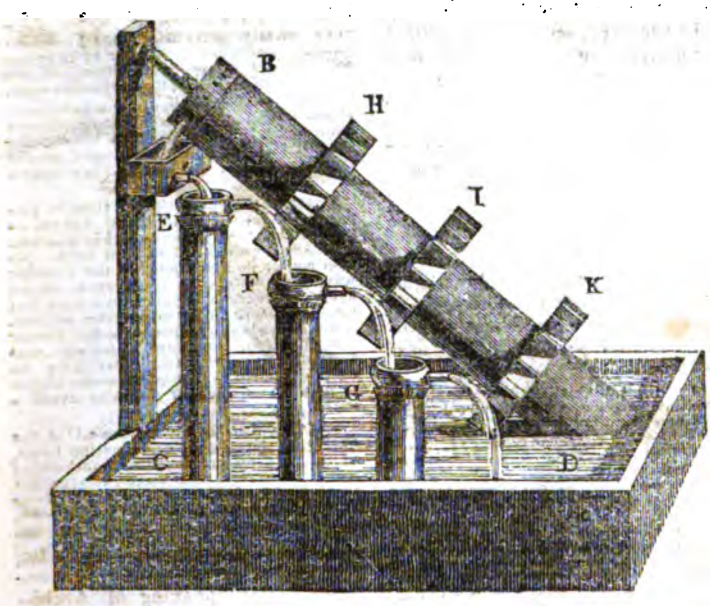
He then reasons on the failure of his experiment, and states, that a bullet, when attracted by the magnet, will not *roll* but *slide*; and that if the magnet had strength to draw it in a sliding motion up the inclined plane, when it got so near as the hole, it would be drawn to the magnet, and would not fall. He then proceeds :—

"So that none of all these magnetical experiments" (having before mentioned some) "are sufficient for the effecting of a perpetual motion, though these kind of qualities seem most conducible to it, and perhaps hereafter *it* may be contrived from them."

2nd. After speaking of Archimedes' screw, he says, "If there were a water-wheel made on this instrument, upon which the stream that is carried up may fall in its descent, it would turn the screw round, and by that means convey as much water as is required to move it; so that the motion must needs be continual, since the same weight which in its fall does turn the wheel, is by the turning of the wheel carried up again.

"Or if the water falling upon one wheel would not be forcible enough for this effect, why then there might be two or three, or more, according as the length and elevation of the instrument will admit, by which means the weight of it may be so multiplied in the fall, that it shall be equivalent to twice or thrice that quantity of water which ascends, as may be more plainly discerned by the following diagram.

"The lower cistern, which contains the water, C D. Now, the cylinder B being turned round, all the water from the cistern, which ascends through it, will fall into



the vessel at E, and from that vessel being conveyed on the water-wheel H, shall give a motion to the whole screw; or if this should be too weak, then the same water which falls from the wheel H being received into the other vessel F, may from thence again descend on the wheel I, by which means the force of it will be doubled;* and if this be yet insufficient, then may the water which falls on the second wheel I be received in the other vessel G, and from thence descend on the third wheel at K, and so for as many other wheels as the instrument is capable of; so that, besides the greater distance of these three streams from the centre, or axis, by which they are made so much heavier, and besides that the fall of this outward water is forcible and violent, whereas the ascent of that within is natural; besides all this, there is thrice as much water to turn the screw as is carried up by it.

"But, on the other side, if all the water falling upon one wheel would be able to turn it round, then half of it would serve with two wheels, and the rest may be disposed of in the fall so as to serve unto some other useful and delightful end.

"When (says he) I first thought of this invention, I could scarcely forbear, with Archimedes, to cry out Ευρηκα, Ευρηκα, it seeming so infallible a way for the effecting a perpetual motion, that nothing could be so much as *probably* objected against it; but upon trial and experience, I find it altogether insufficient for any such purpose."

He then gives some very correct reasoning why this experiment fails; but I have taken up so much of your space, that I shall now conclude, and subscribe myself

Your humble servant,

SINNED.

"* There is another similar contrivance to this purpose in Pet. Bettin Apiaz 4 Pogym 1, Prop. 10, but with much less advantage than it is here proposed."

COMBINATION LAWS.

In our last Number we concluded the observations which we had ourselves to offer on this subject. We now commence a selection of the more essential portions of the evidence which has been adduced before the Committee of the House of Commons appointed to inquire into the state of the Combination Laws, and their effects.

Mr. Martineau, whose testimony strikes us as altogether remarkable for the combination of philosophical intelligence and gentlemanly propriety which distinguish it, examined—

Do you not think that there should be some summary way of *enforcing* the fulfilment of a contract?—No *good* workman in a manufactory *properly conducted* would be *inclined* to leave his work unfinished; and as a manufacturer, I should say, that if I had men of a different description, *the sooner they were gone the better.*

Mr. Place, from whose evidence (though that of a friend to the cause) we anticipate but little good to the cause of the workmen,* examined—

Have you had much experience with respect to clubs, and combination of workmen and their employers?—Yes, I was for some years a journeyman myself, and got sadly punished by the masters combining not to employ me; this was for having interfered in a combination of the men, with which I had nothing to do, until forced by the masters to join it. I afterwards formed several clubs, for the purpose of compelling the masters to give an advance of wages. I thought then, and still think, it was proper. Wages were very low in some trades, and the workmen had no other means whatever to procure an increase. These combinations of the men were all of them ultimately successful.

Were the combinations to which you allude the consequence of any supposed understanding or combination among the masters to keep down the wages, or did they begin with the men?—They began with the men.

What was the foundation of them?—The desire to increase their wages. I give, as an instance, the leather-breeches makers, the trade to which I had been bred. No man could, in that trade, in the regular way, earn more than 14*s.* a week, on an average; other journeymen, in trades not requiring more time to become expert, could earn about a guinea a week. Under my direction, therefore, a society was formed, and within two years from its commencement, the masters were obliged to give an advance of wages to avoid a strike.

What opinion have you formed of the effects of the present Combination Laws, so far as they prohibit combinations of workmen, to raise their wages, or regulate their hours of working?—I think those laws produce no good effects whatever; they appear to me to be wholly pernicious. They are a bond of union to the men. I know, practically, that the men have been kept together by them, when no combination would otherwise have existed.

Is there not a combination among the journeymen tailors?—The journeymen tailors have a *perfect and* PERPETUAL combination among them. I have known only of two combinations among the masters; one was to resist the men, the other was to obtain an Act of Parliament; the first failed, and the last was not persevered in.

What was the cause of the journeymen tailors' combination, and what is the system they now pursue?—The system is *all but a military system.* The orders come from their *executive*, and are always obeyed. There are upwards of twenty regular, or flint houses of call in London; each house has a delegate, and they elect five other delegates, who are technically called the Town. In many cases, the power of these five men is *almost unlimited over the trade*, and *obedience follows as matter of course.* The whole body *never, in any instance, discuss the propriety of a strike*, as that would subject them to prosecution under the Combination Laws. Unlimited confidence is, therefore, given to the Five; and this it is which constitutes their power.

Do the men generally know who are the regulators?—No. It is whispered among them that there is to be a strike, but *they never discuss the subject; they strike when bid.*

By whom is the rate of wages fixed?—By the men. The Town, as it is called, announce the sum, to which the men conform.

Will you explain why the masters never suffer; suppose the Town should say, that it is necessary to have 7*s.* for a day's work, instead of 6*s.*?—They have never struck for wages *but when circumstances have justified them.* They have *never demanded an unreasonable sum*, as compared with

* We advocate unreservedly the abolition of the Combination Laws, but not, certainly, *in order that combination may be produced.* We have no corner in *our toleration* for the idea that "*if* the men could *legally combine.*" There *may* be such a thing as a *legal* combination, as that which is now open to the masters proves, but we hold that, were ALL *interests on an equal footing, in point of legal protection*, ALL combination on either side must be as unfair as injurious. The picture which Mr. P. gives of the existing combination among the journeymen tailors of London, and on which he seems to dwell with pride and satisfaction, presents to our minds only matter for commiseration and sorrow. That so "large a body of men" should be linked in "a perfect and *perpetual* combination," under "*all but a military system of government*;" that they should have "*always obeyed*," and be *always prepared to obey* the orders of *an executive* of five, without once taking the matter into their own "serious consideration," is most deplorable. Depend upon it, Mechanics! should you now fail in your endeavours to obtain the abolition of the truly obnoxious Combination Laws, it will be these *military tailors* who have undone you.—*Edit.*

the actual value of the sum they formerly received.*

Do all journeymen tailors receive the same wages per day, whether they are good or bad workmen?—There are several ways of settling wages among tailors. They are divided into two classes, called Flints and Dungs. The flints all work by the day, and all receive the same wages; the dungs work by the day, or the piece, but generally by the piece. No inconvenience to the master arises from any of their arrangements; they all get a day's work for a day's pay.

Are the dungs promoted to be flints?—Some dungs become flints. Day-work, in our business, may be called piece-work, with this limitation, that a man will only do a certain quantity in a day. We have books ruled in columns, in which are inserted the name of the workman, the name of the garment, the name of the person it is intended for, and the time the man is employed upon it. Thus a complete check upon the men is established, and every one of them must do his stated quantity.

What proportion is there of dungs to flints?—I think about one in four.

Have you ever known a master prosecuted by the men for combination?—No; I believe it would be nearly impossible to prosecute a master to conviction. To prosecute at all, money must be raised; to raise money, there must be a combination among the men, and then they may be prosecuted by the masters. If, as the law now stands the men were to prosecute the masters, there would be a cross prosecution. The Combination Law compels the men to give evidence against one another, and thus the prosecution may almost always be effectual. No law compels the masters to give evidence against one another; thus it is almost impossible ever to convict a master.

Are the Committee to understand, that no combination of masters can be prosecuted unless the men combine for that purpose, and that this combination of the men to defend themselves is immediately prosecuted, and that this prevents the masters being convicted?—Yes; the men can never prosecute the masters without a fund; a fund can only be raised by combination, for this they may be prosecuted; but suppose there should be no cross prosecution, still, as the masters cannot be compelled to give evidence against one another, as the men are compelled to do, a conviction is all but impossible.

You think therefore, that the Combination Laws press on the men and not upon the masters?—They are unequal and unjust.

Have not the journeymen in one trade assisted the journeymen in another trade, with money to support them during a strike?—Yes; I have no doubt that the tailors have given away more money to others in this way than any other trade; they are a large body of men, and can easily raise a large sum by a small contribution from each; they have, as I have been informed, given a hundred or two hundred pounds at a time in this way; the cause of this is wholly ascribable to the Combination Laws.

Is not money always subscribed to support a strike, and would that be the case if the law were repealed?—It has always been the case; it would no longer be necessary if the law were repealed; if the men could legally combine, disputes would seldom occur, but when they did, they would be settled by compromise between the parties.* Workmen dread a strike; I know well, from experience, that a strike is always a matter of serious consideration, and never can be effected unless it be actually necessary, except among the tailors, whose executive enjoys the fullest confidence of the men, of which it is really worthy, a strike is a most difficult thing to accomplish. Many interests and many tempers must be consulted, soothed, and compromised, and so general must be the sense of its necessity, that money must be voluntarily subscribed for a considerable time before the attempt can be made. The influence of the women in the case of a strike, is of much importance; they never consent but in extreme cases; they suffer by far the most in a protracted strike; and those who can suppose that their apprehensions and persuasion have but a small influence on the men, know nothing of the principles of mankind, and nothing from experience.

(To be continued.)

EMIGRATION OF ARTIZANS.

The committee appointed by the House of Commons to inquire into the effects of the Combination Laws, have it also in charge to examine evidence as to the policy of two other sets of laws in which our friends the mechanics are peculiarly interested;

* To suppose that they *never will do so*, however, is to suppose human nature is infallible, and the *past* good conduct of the fraternity can therefore be no reason for not providing, *as far as law can provide*, that *this and every other combination* shall henceforth cease. *A combination* to obtain a certain price for labour is but a species of intimidation, and that is already provided against by common law.—*Edit.*

* This is not *evidence*, but *prophecy*; and as is ordinarily the case with *prophecy*, *every thing* is required to be taken upon *trust*. We should like to know on which of "the principles of mankind" the witness founds his forward conviction that "*if the men could legally combine*," they would *always* "compromise" matters with their employers. Does he mean to say that *absolute power* can be a safe thing only in the hands of journeymen mechanics? And to what else than absolute power does all combination tend? The workmen may rest assured that till *combination on both sides* is utterly done away with, the respective rights and interests of both parties will never be placed on their proper footing. Let things take their *natural* course, let every *artificial* effort to exalt or depress be abandoned, and labour, like any other commodity, will be as sure to obtain its real value in the market as water, when left to itself, is sure to settle at its natural level.—*Edit.*

namely, those which prohibit artizans from leaving the kingdom, and those which make the exportation of machinery illegal. The more prominent parts of the evidence under each of these heads we shall also lay before our readers. And first, as regards the Emigration of Artizans—

Mr. MARTINEAU examined—

Is it necessary for you to send artizans abroad to carry on your own business?—Certainly, when we send machinery abroad we are under the necessity of sending men to erect it; that generally forms part of the contract which we enter into with the parties for whom we construct it.

What kind of workmen is it that are generally enticed to go abroad?—They invariably entice the best workmen; a considerable risk and expense is incurred in getting workmen over from this country, and, added to this, a large bribe is necessary, so that it would not be worth while to incur all this risk and expense for the sake of obtaining inferior workmen.

Can you state any cases in point?—I have myself had repeated instances of attempts to entice away my own men; about three years ago I had a considerable number of my men enticed away for the works at Chaillot; they were of the best description of workmen, and men employed by me on work which I wished for a time to keep private, for it was the subject of a patent.

Have you any late examples where any attempts have been made to entice your men?—I have received within these few days a letter from Paris, stating that two Englishmen had come over, and that one of their objects in London was to entice men from our manufactory in particular; I immediately sent this letter into the manufactory, in order that the men might see, if any of them were disposed to go to France, that an opportunity offered itself, and that I did not intend to prevent their going; *the consequence was, not a single man left me, though I had reason to believe that the terms offered were very high, and very advantageous to them.**

Suppose the law now existing to be repealed, what description of men would be the most likely to go abroad?—I have no doubt but that the inferior workmen would be the first to go; those, in fact, who found it difficult to get employment in this country; I am persuaded that our superior class of workmen would never leave their country, if attempts were not made under the existing laws to entice them away by high bribes.

Do you think that many of the best workmen who go abroad now from a freak, or perhaps to see the country, would be disposed very soon to return, but for the penalties of the law which now prevent them?—I think that very few would leave the country; but that those few who did leave it from the circumstances referred to, would be very glad to return.

Would not perfect freedom to go or stay render the men more satisfied, and less likely to make a permanent emigration than now?—I am persuaded if the law were repealed, very few of them, or at any rate, of such as are worth keeping here, would go; from my knowledge of the habits of the men, I am persuaded they would be quite satisfied, if they only had the right to do so.

Have you any fear that the country would suffer by the rivalry of other countries, if perfect freedom was given to the artizans to go abroad?—I am satisfied that it would not suffer, for the reason I have already given, viz. the inferior workmen going instead of the superior.

Have you seen any men who have returned, and can you state what report they made of the establishments abroad, or of their liking the situations they are in?—Not of my own knowledge; but my partner was residing at Paris about two years since, and had opportunities of conversing with English artizans there, and most of those he saw expressed a strong desire to return to England, *but their passports were refused them.*

Mr. ALEXANDER GALLOWAY examined—

Is the law prohibiting artizans from going abroad to execute their calling effectual or not at the present moment?—Totally ineffectual, if I may judge from experience.

Can you state in what way they go out of the country?—There are many ways that they can leave it with perfect safety. If I was a foreigner, and wanted men without any introduction in England, my object would be to attend in the neighbourhood of any manufactory at the dinner-hour, or the breakfast-hour, or their hour of quitting the manufactory, and there obtain a knowledge of any of the men I wanted; every manufactory furnishes such information; I have eighty or ninety men; if any person wanted to get any of my men away, to go abroad, he has only to watch at my gates as they come out and in, and get the names of the most able men, and many engagements of this sort have been made in this way: when I was in France, in 1818, the very day I came home, six or eight of my men left to go to the continent.

How do they get out of the country?—The most prudent of them have generally said that they had some business, and wished to go into the country to see their friends; they have got leave of absence for a few days, and we have heard no more of them, till we were informed they had left the country.

Do you know in what manner the engagements with artizans enticed abroad have been kept in France?—I have known instances on the Continent, *where four and five guineas a week have been promised in England*, and the men have left it in the expectation of receiving those four or five guineas a week, and, after they had been abroad for a few months, and after, in fact, they had instructed their employers, and gave them possession of their knowledge, particularly as regarded the instruction of the native workmen, their employers have had the injustice and bad faith *to reduce their wages to two guineas a week, or*

* May such liberal conduct on the part of the master always meet with an equally grateful return.

ies, and these English workmen have been obliged to submit to such reductions, from the difficulty and danger of getting back.* This is a thing within my own knowledge.

(*To be continued.*)

EXPORTATION OF MACHINERY.

Mr. Bryan Donkin, Mr. Timothy Bramah, Mr. Philip Taylor, Mr. Henry Maudesley, and Mr. John Hague, all engineers, examined—

Will you state whether, of your own knowledge, there is a very considerable demand for English machinery in almost every part of the continent?—Certainly there is.

Mr. TAYLOR.—A very great demand. If persons from other countries are driven from our market to a dearer one, by the prohibitory laws, they will probably go to France for their supply.

Mr. BRAMAH.—I can state an instance which happened within this fortnight; I am making some machinery for packing cotton, to be sent to Egypt; the agent in London wanted a number of machines for carding wool; he referred to me, to know how he could get them supplied, as they were not allowed to go out of this country. I gave him the address of Mr. Cockerell, of Liege, who is one of the largest manufacturers, and has been almost exclusively employed for twenty-seven years, in making machinery for cotton and wool manufacturers; he is an engineer who went out from Manchester, and has realised an immense fortune.

Will you state the nature of that manufactory?

Mr. MAUDESLEY.—It is a large manufactory; they have one at Liege, another at Sarang, about four miles off; that at Sarang was the Bishop of Liege's palace. I suppose that manufactory must at least cover seven acres of land, and they employ about five or six hundred people; they wanted me to take orders for a great deal of machinery, but I told them it was impossible. The king of the Netherlands has given Mr. Cockerell 30,000*l.* for the purpose of establishing an iron-mill, and extending his manufactory to the making boat-engines and steam-engines in general. The manufactory at Liege is principally for carding and woollen machines.

What countries do they principally supply?—The whole of the continent: I have seen hundreds of their carding machines in France.

Can you state whether there are any other manufactories on the continent, in Prussia, or any other country?—There is a very large manufactory established by one of the brothers of Cockerell, at Berlin, for cotton and wool.

Mr. Martineau examined—

Have you, in the course of your business, received orders for tools and machines from abroad?—Frequently.

Have you executed those orders?—That has depended upon the description of machines ordered; whenever they have come under the description of machines prohibited by Act of Parliament, I have refused to execute them, because it would be necessary to enter them under false names, in order to deceive the officers of the customs.

Could you have exported them by entering them under another name, if your scruples of violating the law had been satisfied?—Certainly; it would have been utterly impossible for the officers of the customs to detect the nature of the machine when it was sent away in parts.

From your own knowledge, do you consider it an easy matter, by breaking up machinery, and exporting it at different times and by other names, to send abroad any thing you please?—I think any prohibited machinery might be sent abroad by a little management; there is one obvious mode, which would be that of mixing two or three machines together in such a way, that no officer of the customs, or indeed any engineer, could detect the nature of the machine exported; and detection would be still further prevented by shipping these parts so mixed, at different periods.

Have not some manufactories been established in foreign countries for the purpose of making machines and tools which the laws forbid you to export?—Many manufactories have lately been established, and more particularly in France; and no doubt one of their objects was to manufacture those machines, the exportation of which from this country is prohibited; but they likewise manufacture various machines, which are not prohibited to be exported from this country.

Are not those manufactories, or many of them, conducted by Englishmen?—I believe almost entirely; the three principal manufactories at Paris are conducted by Englishmen—viz. the works at Charenton, by Mr. Manby; those at Chaillot, by Mr. Edwards, and a third by a Mr. Steele.

Can foreigners at present manufacture tools and machinery, generally, as cheap or as good as they can be purchased here?—Certainly not so cheap. In the first place, their labour may be stated at least, from 25 to 30 per cent higher than it is in this country, arising from the circumstance of their generally employing English workmen; the raw material is at least or even more than cent per cent higher than the raw material in this country.

Are you able to state what is the relative difference of wages given in the same manufactory in France, to Frenchmen and to Englishmen engaged in the same branches?—I will state an instance of a smith, which may serve as a criterion for all; a smith in France would receive about four francs per day, while the rate of wages paid to an expert English smith at Paris would be ten or eleven francs per day.

Do you think if the trade was free, English engineers would supply the greater part of the world with tools and machinery?—I have no doubt but that they would.

Can you state any rules for forming that opinion?—My reasons for it principally consist in the natural advantages that England possesses, from the circumstance of

* Passports, as the preceding witness states, have been *refused* them.

the iron-stone and coal being invariably found in the same spot, and thus affording a means of manufacturing iron at a cheap rate; the talent and ingenuity of the workmen; the immense spare capital we have in this country; the circumstance of our canals and rail-roads already established, enabling us to bring the raw material from the interior of the country at a very low rate; it would of course take a considerable time before France or any other country could possess any of these advantages, even those which cannot be considered as peculiar only to us, such as canals and rail-roads.

At the three principal places of manufacture of iron in the neighbourhood of Paris, do you know what number of Englishmen are employed at each?—I think there are at least from three to five hundred in each of the two principal manufactories, namely, those of Chaillot and Charenton.

Mr. Galloway examined—

Is the larger proportion of that machinery that is forbidden, of the finer or coarser kind?—I consider that both classes are prohibited under the Act; indeed, under the 26th Geo. III. there are very few things in the shape of machinery or tools, that can be permitted to be exported; and those articles of machinery that have been exported are, generally speaking, those articles that the Custom-house officers could not comprehend; a screw, for example, I cannot, by any species of disguise, prevent meeting the common understanding of every Custom-house officer; but a machine which can generate any number of screws, he has not the least knowledge of, and consequently permits it to pass.

Of your own knowledge, have a great many prohibited articles been exported?—Morally, as well as legally speaking, I believe to a considerable extent.

Are you aware of any instance in which any of those machines have been converted to other purposes?—I know that machines have been made to appear for one purpose when they were meant for another, and have been converted accordingly.

Cannot specifications or descriptions of every new machine, with drawings and models, be easily obtained in this country by any foreigner?—With the greatest facility; for instance, with all our patents, there are regular drawings obliged to be made, and any man who will go to the expense of paying for them will get them.

(To be continued.)

WIGHTMAN'S PERCUSSION LOCK.

Malton, Feb. 8, 1824.

Gentlemen;—In the 18th Number of the Mechanic's Magazine, I saw a description of a percussion lock which I made two years ago. Had I been acquainted with the intention of my unknown friend, the "Admirer of Field Sports," of inserting it in your widely-circulated Journal, I would have given you my latest improvements, which can now only be done by a new plate; and were I to request this, I could only consider it as an encroachment on your spirited exertions to diffuse useful information by descriptive engravings.

The best preparation for the priming powder for percussion guns is antimony 3 parts, chlorate of potash 1 part. On account of the corrosive properties of the chlorate of potash, it is advisable to use the smallest possible quantity that will be certain of ignition; the above ingredients, if well compounded, form a percussion powder that will fire with the greatest certainty, as has been not only proved by my own practice during the whole of last shooting season, but by the testimony of sportsmen of the first eminence.

One great objection to the stronger preparations for priming is, the great and sudden corrosion produced after firing. So violent is this, that should the interval between firing much exceed an hour, the touch-hole is not unfrequently completely closed by a strong rust.—Yours, &c.

W. E. Wightman.

POSSIBILITY OF A PERPETUAL MOTION RE-ASSERTED.

Brill Row, Somer's Town,
Feb. 14, 1824.

Gentlemen;—Of Mr. Bevan's abilities I will not presume to doubt; that he is acquainted with the laws of mechanism and of motion, the cause which "draws the stone projected to the ground," is of course; yet, with all his knowledge of cause and effect, the nature of fluid or the weight of matter, I do not think it is well in him to attempt to stop the inquiries of the present or the rising generation, as he seems to be desirous of doing, by his demonstration, entitled "No Perpetual Motion." A mechanic, in the ardour of youth, full of impetuosity, will take every fragile structure formed in his imagination as a piece of durable architecture; but it is not so with one who carefully for years considers, who weighs probability against possibility, before he runs the risk of writing against what are called "established facts," though established facts with those who attempt to overcome difficulties are but as customs to the wise. I will tell "R. B.," that what I asserted, I will still assert, and that I am not beholden either to cocks or valves to obtain the perpetual motion I have discovered. When the world, or these philosophically wise in the world, are acquainted with its principles, they will wonder at its simplicity, and will say, as was said to lord Napier, when he invented the logarithms, "How is it we never discovered before that which is now so plain"?

Yours, with the greatest respect,
F. J—k—m

WILLIAMSON'S IMPROVED LATHE.

Feb. 16, 1824.

Gentlemen;—Allow me to ask Charles Williamson what sort of line he uses to his lathe, and how he prevents the one part of the line from cutting or chafing the other? [See p. 369].

I have made the addition he so kindly points out to my lathe, and am of opinion, that it will answer every purpose, if the above difficulty (for such I have found it) can be got over. I put on a catgut line, and in ten hours wear, it was so reduced that it broke, although I varied the shape of the groove in the mandrel pulley six different times.

A Working Turner.

INQUIRIES.

[All inquiries will in future be numbered, and the answers to them inserted in the numerical order of their application.]

No. 1.—TREVETHICK'S ENGINE.

Salop.

Gentlemen;—Should this meet the eye of some of your Cornish readers, resident in the neighbourhood of Truro, I should be much obliged to any one, competent so to do, if he would inform me, either through the medium of your publication, or otherwise, whether the Hydraulic Engine which was erected some years ago at the Druid Copper-mine, in the parish of Illogan, near Truro, by Mr. R. Trevethick, has fully answered its intended purposes. There are so many instances of practice falling far short of theory, even under the auspices of the most ingenious, that I trust I shall not, by this inquiry, be supposed to call the abilities of the inventor into question. One objection to hydraulic engines on a large scale is the great degree of friction attendant on the working gear; but even *with* that objection, there are many opportunities for their advantageous application. A discussion upon this sort of engine is not, however, my present object; that which I seek to know is, whether the hydraulic engine of Mr. R. Trevethick, either at Illogan (or any other place where one may have been erected), has acquitted itself in such a manner as to render it deserving of adoption in situations where facilities present themselves for its application. I would also be glad to learn whether it winds as well as pumps, the depth to which it works, and if it often requires repair.

Hoping this may engage the attention of some of your readers, who may be kind enough to furnish me with the desired information,

I am, Gentlemen,
Yours very obediently,
Geo. E. Hamilton.

No. 2.—BORING WELLS.

The inhabitants of the low lands and marshes adjoining the river Wavenery (county of Suffolk) are often put to great inconvenience in summer from want of water, although their wells are usually sunk below the level of the bottom of the river. As far as I know, the banks are formed of four distinct strata:—1, a loose oozy alluvium, five feet deep; 2, A loose white sand, fifteen feet deep; 3, a close-grained bog earth, twelve feet, very black; 4, an earth resembling the last, but mixed with fine sand, and a few fragments of muscle and cockle-shells.

The uplands in the neighbourhood rise from 50 to 100 feet above the level of the river In sinking wells, I have found no difficulty in getting down my brick-work five or six feet into the second stratum (a loose white sand); but at this depth the water from the land-springs becomes troublesome, and the sand falls in in such quantities, that the curb on which the brick-work rests, will not settle downwards. From the bottom of a well, ten feet deep, I have lately bored thirty feet without finding any main spring: the soil being loose, it lies close to the borer, and has prevented me getting further down, although four hands were employed. When the borer is withdrawn, the aperture is immediately filled, and all our work must be gone over again.

Will any of your correspondents be so kind as to inform me, through the medium of your Magazine, by what mode I can reach the main-spring; if by pipe, what method ought to be used to get it down. As these wells are usually paid for by the foot, I have often been inadequately paid, owing to the time taken up in getting brick-work through this loose sand, which blows up nearly as fast as I can erect the brick.

A Constant Reader, & A Well-Sinker.

NORTON'S SPIRAL WHEEL.

Gentlemen;—I had a model of a similar wheel to that invented by Mr. Norton, and noticed in your last, made about twenty years ago, and thought at first it would be useful in tide-mills. I accordingly tried it both ways, horizontally and vertically, but found the power so much less than that of the common water-wheel, on account of the greater friction caused by the water sliding along the screw, and the great pressure endways of the bearings, as well as the difficulty of keeping the water on the wheel without waste between the spiral floats and the casing (which was a complete cylinder), that I came to the conclusion that it could never be used to advantage. X. Y.

NEW PATENTS.

To Francis Devereux, of Cheapside, merchant; for certain improvements on the mill or machine for grinding wheat, and other articles, commonly known by the name of the French Military Mill.—8th January, 1824.

To Joseph Foot, of Charles-street, Spitalfields, silk-manufacturer; for an improved Umbrella.—15th January, 1824.

To John Finlayson, of Muirkirk, Ayrshire, farmer; for certain improvements on Ploughs and Harrows.—15th January, 1824.

To Jean le Grand, of Lemon-street, Goodman's-fields, vinegar manufacturer, for certain improvements in Fermented Liquors, and the various products to be obtained therefrom. Partly communicated to him by a certain foreigner residing abroad.—15th January, 1824.

TO CORRESPONDENTS.

We thank T. M. B. for his suggestions.

Veritas, who speaks not for himself alone, but "the sentiments of many," will find his queries partly answered by our account (in the Supplement) of the first Quarterly General Meeting of the Institution: we possess no other information on the subject. He had better apply to the Secretary, or to the Committee of Managers.

Communications in hand for insertion of J. Y.—H. D.—H. T.—C. C.—W. K.—J. B.

Communications received from J. S.—T. B.—A Mechanic—No Mechanic—Philanthropus—Alexander Brandt—T. J. Simpson—Son of a Mechanic—Journeyman Carpenter—G. J.—Gurboss—A Constant Reader—C. H.—Combustion—K. L.—G. R.—Specific—R. B.—John Goode—G. B.—Nauticus (whose proffered communications we shall be glad to receive)—X.—H.—W. Pennyston, Jun.—C. L. Y.—A. R. K.—Measurage—and J. M.

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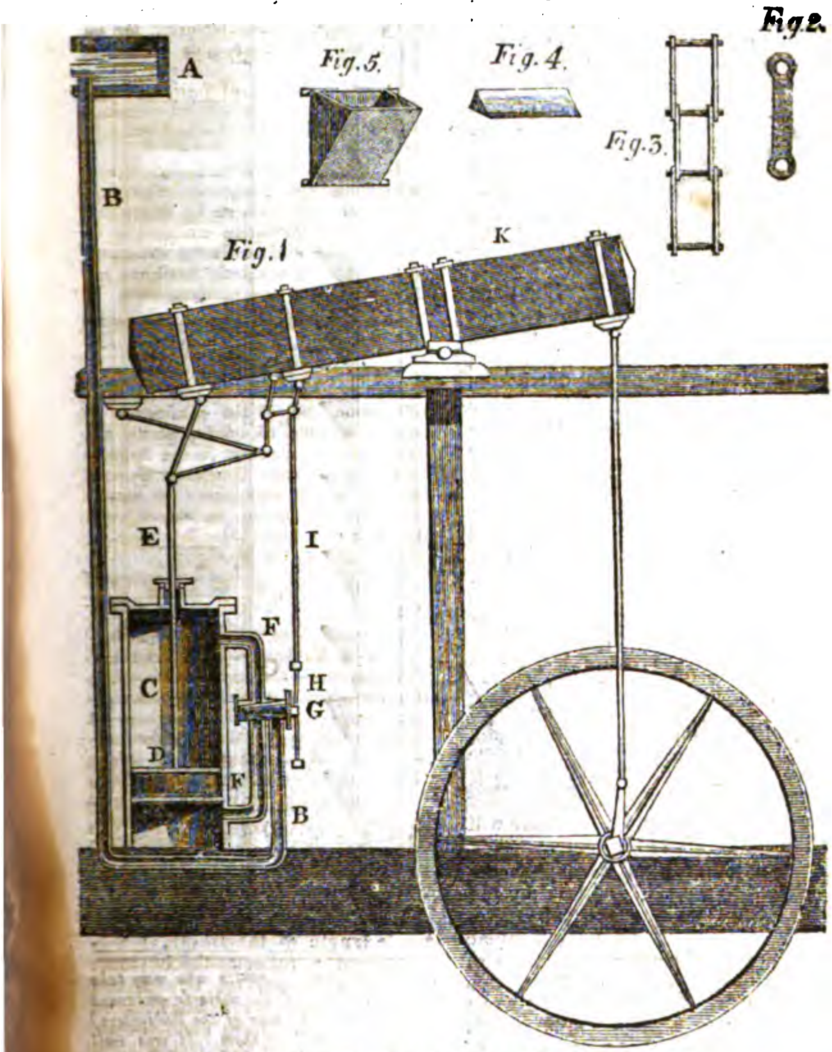
Communications from intelligent Mechanics, and from all others who may take an interest in the diffusion of useful information on any of the subjects embraced by this work (addressed to the Editor, and post-paid, to the care of the Publishers) will be thankfully received, and have every attention paid to them. It was well remarked by the great philosopher, Boyle, that if every artist would but communicate what new observations occur to him in the exercise of his trade, the advantages gained to philosophy would be incalculable.

T. C. Hansard, Pater-noster Row Press.

Mechanic's Magazine,
Museum, Register, Journal, & Gazette.

Invention furnishes Art with her materials without it Judgment itself can but steal wisely.

No. 30.] SATURDAY, MARCH 20, 1824. [Price 3d.



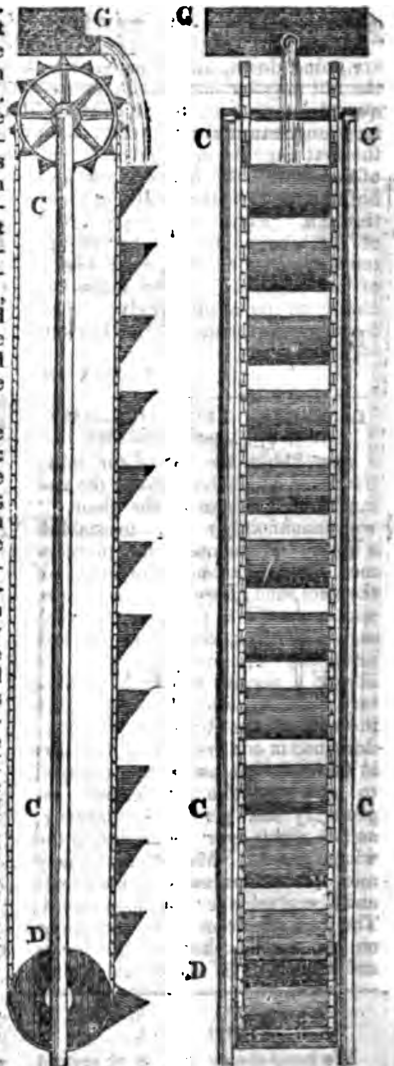
TO MAKE THE MOST OF A FALL OF WATER.

22, Brill-row, Somers'-town.

GENTLEMEN; — The inquiry of your correspondent, "A Miller in the Mountains" (Vol. I, p. 351) has suggested to me two plans, either of which will, in my humble opinion, answer the purpose required. By the one plan I propose that there should be an iron pipe, the whole height of the water-fall, with a cistern or receiver at the top. The pipe, when filled with the water, will of course possess a pressure equal to its weight. Let this pipe, therefore, be connected with an engine, similar in its construction to a steam-engine; for it must have a cylinder, a piston, piston-rod, parallel motion, a beam, fly-wheel and crank, a pair of nozzles, and a two-way cock connected with the main pipe, with each side of the piston in the cylinder, and with a pipe to take off the waste water.

The figure in the preceding page represents the whole of the engine: A is a cistern at the top to receive the water at its greatest altitude; B B the main pipe coming down from it, and leading to the cylinder of the engine; C the cylinder; D the piston; E the piston rod; F F the nozzles leading to the cylinder on each side of the piston; G the two-way cock, which will have always one passage open to the main pipe and cylinder, and the other always open to the waste pipe and cylinder, changing alternately by the handle of the two-way cock, H being struck by the tappets on the rod I, which is worked up and down by the action of the beam K. The water, by being thus worked alternately on each side the piston, will possess a power equal to its own weight; and by regulating it according to the current, so as not to exceed the supply, the force will always continue the same.

The other plan which has occurred to me, is illustrated by the drawings on the present page, which represent an upright frame of the height required. Two of the upright sides of the frame are marked C C; between them works two spur-wheels upon one shaft; over each of these wheels works a chain, so made that the cogs of the spur-wheel work directly into them. These chains are of the



whole length of the frame, working round a roller at the bottom; the roller is marked D. Fixed upon the chains are buckets, at equal distances from each other. Over the top of the frame is a cistern, marked G, in which the water from the stream is collected, so as to bring it directly over the buckets. Now, I think it must

appear clear to your intelligent readers, that in the buckets that are going down, all the water from the fall may be contained; consequently, the whole weight of it will be brought into action. Fig. 2, on the first page, is one side of a link of the chain; the holes at top and bottom are for the bolts to pass through. Fig. 3 represents a part of the chain; fig. 4 one of the teeth or cogs of the spur-wheel, of an angular form, to allow the chain to pass off freely. Fig. 5 shows the shape of the bucket.
—Yours,

F. J—K—N.

LANCASTER MECHANICS' AND APPRENTICES' LIBRARY.

At a Public Meeting of the inhabitants of Lancaster, held on the 2nd instant, the Mayor in the chair, it was unanimously resolved to establish a library for the use of the journeymen mechanics and apprentices of the place, and a respectable committee was appointed to prepare the necessary regulations, &c. It is intended ultimately to connect with the library a regular system of elementary tuition, and Mr. Saul (the inventor of the Revolving Window, described in our first Vol. p. 265) has in the meantime handsomely engaged to give gratuitously lessons on geometry and perspective drawing, on two nights every week during the winter months. May we have many more such instances of an intelligent and liberal spirit to place upon record. The good effects of such institutions on the working classes of our towns and cities will be found incalculable.

AMERICAN MECHANICS' INSTITUTIONS.

We have observed, that at several of the meetings recently held in different parts of this country, for the formation of Mechanics' institutions and libraries, particular reference was made to the example set us by the United States. "There is hardly a town of any consequence in the United States," said one speaker at the Newcastle meeting, "where an institution of this kind has not been established." Now, it so happens, that nothing could be stated of the towns in the United States less true than this. The *only* mechanics' institution as yet known to exist within the Union, is that at New York, established no more than three years ago, and of which Mr. Martineau gave an interesting account at the Public Meeting for the formation of the London Mechanics' Institution [See p. 186, Vol. I]. In the last Philadelphia papers received here, there is an advertisement calling a meeting of "mechanics, manufacturers, and others, friendly to the mechanics arts," to consider the expediency of forming a similar institution; but of its actual establishment we have as yet no account. The manner in which this advertisement is worded deserves attention—"The object of the meeting is to consider the expediency of forming an institute for the benefit of mechanics, on the plan of similar institutions *in all the manufacturing cities in Europe, and that recently established in New York*." We hope, after this, to hear no more of our being so wonderfully outstripped by the Americans in this honourable career. Though the mechanics of Britain have been tardy in starting in the field of scientific inquiry, it is but fair it should be known, that it was *they* who took the lead—*they* who set the example. The oldest American Mechanics' Institution is not yet four years old; while that at Glasgow already reckons its quarter of a century.

CAPTAIN MANBY'S PRETENDED INVENTION.

The public are very generally acquainted with the invention for furnishing assistance to the crews of vessels when wrecked, of which captain Manby has not only taken the credit, but for which he has succeeded in obtaining a large reward from Parliament. It may be sufficient here to mention generally, that it consists in throwing a line between a wrecked vessel and the shore, by means of a piece of ordnance, or of a rocket, a succession of stronger lines being added, until a cable of hawser sufficiently strong to bear the weight of men, is established as a means of communication. The public are not so well aware, perhaps, that this invention is of more than thirty years standing, and was made by Lieutenant Bell, of the Invalid Artillery. Nor was it merely invented, but published in the Transactions of the Society of Arts, from whom he received a premium for it. Nay, more, it was tried at the Arsenal, Woolwich, publicly and repeatedly, so that it was not, as afterwards argued in Parliament, a mere project kept in the inventor's closet, or hid in a corner. Yet the claims of this ingenious and worthy man were slighted, while captain Manby, for the mere revival of the thing, was handsomely rewarded.

We believe that on a subsequent representation, a pension of 50*l.* was settled on the family of Lieutenant Bell; but it is plain, that if any reward were given, they were entitled to the whole.

OBSERVATIONS ON THE BAROMETER, AS APPLICABLE TO THE ISLAND OF CEYLON.

[In an article entitled "Theory of Space," p. 158, Vol. I, an intelligent correspondent adverted to an indistinct newspaper notice of some remarkable observations on the Rise and Fall of the Barometer made at Ceylon, by Colonel Wright. We are now happy in being enabled to give Colonel Wright's observations at length, as they were read before the Ceylon Literary Society.—EDIT.]

The scale of variation in the barometer being of a very limited nature between the tropics, compared with that of latitudes at a greater distance from the equator, makes that valuable instrument, in general, be considered, especially by superficial observers, as of little service in the former case; yet there is no doubt but by an attententive and careful observation, it may be made subservient to many useful purposes, and become, in the hands of the agriculturist and navigator, an equally valuable instrument even in low latitudes. It is only necessary to know its scale and its language. A sudden fall of two or three tenths of an inch of the mercury in the tube is probably the prognostic of as great a change in the atmosphere as the fall of as many inches in some other parts of the world; and as the observation is as readily made in one case as the other, it becomes of importance to be noted.

The following remarks and observations, made during a period of several years in Ceylon, are offered, not with a view of establishing any fixed principle with regard to the above instrument, and of the laws by which its movements are regulated, but more to serve as general hints in any future observations that may be made, and to afford the opportunity of forming comparisons therein with any observations made in other parts of India, and between the tropics.

At Colombo, which lies in latitude 6° 56' North, and close on the sea-shore, the barometer appears decidedly to undergo four periodical changes or revolutions in the course of twenty-four hours, amounting in general to about one-tenth of an inch, being highest about nine o'clock in the morning, sinking towards three in the afternoon, rising again towards nine at night, and sinking again towards three in the morning. There does not appear to be any sensible difference between the position of the mercury in the tube in the morning and at night—the point at which it stands in the morning being generally the same as at night.

Heavy rains do not affect the barometer in an equal degree proportionally with that in high latitudes, nor do hard squalls of a sudden nature or short duration affect it any more than in other parts of the world; but a smart gale of wind of any strength and continuance will sink the mercury to the extent of about three-tenths of an inch; and though that change may not take place so great a period of time previous to the gale commencing as in other latitudes, yet still, by a careful and attentive observation, it will give a sufficient warning of the approach of a gale, so as to prove of very great utility to ships at anchor in the roads of Colombo, or off the coast. In the month of November 1819, previous to the commencement of a smart gale of wind from the north-west, the mercury, which had been at 29·9 inches, fell to 29·7, with the thermometer at 76° of Fahrenheit, and remained low during the continuance of the gale, and gradually continued rising previous to the gale abating, and in several similar instances it has never been known to fail.

The variations in the rise and fall of the mercury do not appear to be affected in any remarkable manner, or influenced by heat or cold, or to undergo any changes with the thermometer in similar cases, but it appears to stand highest in steady, fixed, settled weather. The different monsoons do not appear to affect it, though at the changes thereof a variation takes place in its rise and fall.

The average height of the mercury throughout the year may be considered as about 29·9 inches; the highest range 30·1 nearly, and the lowest about 29·7, making the greatest range somewhat near half an inch; and this observation may be considered as applying to barometers on board the ships in the roads and off the coast, as the difference probably is very trifling between those and barometers on shore, and near the sea-coast on a low elevation.

No sensible difference has hitherto been observed in the barometer on the western and eastern sides of the island, for, at the time of a gale of wind on the western side, during the south-west monsoon, the same changes occur in the rise and fall of the mercury on the eastern side, and *vice versâ*.

In the city of Kandy, situated at the distance of about eighty miles inland, and at a computed elevation of about 2,500 feet above the level of the sea, during the month of October, the maximum of the barometer, while the thermometer was at 76° of Fahrenheit was 28·452 inches, and the minimum while the thermometer was 70°, was 28·272. Sufficient observations have not as yet been made to determine with accuracy the general average height, but it may be considered as about 28·3 inches; and similar to what occurs at Colombo, it is always higher in the morning about nine o'clock, and at night, than at the hour of three. In fact, this periodical rise and fall of the mercury appears of so fixed and established a nature, that there is no doubt an attentive observer of the barometer may thereby mark the above hours and intervals of time with very tolerable accuracy, where the state of the atmosphere and the weather has not, during the time of observation, undergone any very material change.

The following additional remarks and observations on the Barometer, though not applicable to this island, may notwithstanding be deemed not unworthy of a place in the Transactions of the Ceylon Literary Society.

At the Mauritius, or Isle of France, in the month of January 1819, the mercury in the barometer falling to 29·10 inches, was followed by a very violent hurricane; and as the gale abated, the mercury again gradually rose and continued rising till it reached 29·80 inches, the thermometer of Fahrenheit during the time of the gale varying from 75 to 81 degrees.

At the town of Port Louis in the month of February, being the middle of summer, while the average height of Fahrenheit's thermometer was 86°, that of the barometer was 27·7¾ in French inches and lines; the English foot being to the French as 12 is to 12·816.

At Madras, in the month of October 1818, the mercury in the barometer fell to 28·78 inches, which was considered as unprecedented at that place, and was followed by a very violent gale of wind, which gradually abated as the mercury continued to rise, until it reached the height of 29·8 inches, which it had been at the previous part of the day. The thermometer during the time of the gale was in general about 74 degrees: and at the same place, in the month of May 1820, the mercury fell eight-tenths of an inch below the height which usually indicated a gale of wind, and was accompanied by a very heavy gale, and an unusual fall of rain.

Off the Cape of Good Hope, the mercury in the barometer falling down to 29·60 inches, is almost invariably the prognostic of a storm; the usual average height is that of about 30 inches, and to which height it again gradually rises as the gale abates, and continues at that elevation while the weather is serene and fair. A good Marine Barometer is there of absolute and essential service, as these gales often come on suddenly, without any remarkable change in the appearance of the heavens or atmosphere, but are invariably foretold by the barometer. It is however to be observed, that the steady strong breezes, almost approaching to a gale, and which blow there from the south-east in the summer season, have a tendency to raise instead of sinking the mercury. In that latitude it is not ascertained if the periodical changes already alluded to take place the same as at Ceylon, though probably not, as that very extraordinary and unaccountable circumstance appears to be confined to the tropics and equatorial region. The mercury there has been observed during the month of May to rise to the height of 30·4 inches nearly; but the average height may be considered, as above stated, 30 inches in general.

NO PERPETUAL MOTION.

Portsmouth, Feb. 25, 1834.

GENTLEMEN,—Having on a former occasion given you some ideas on the subject of perpetual motion, I will now take the liberty of adding to them.

I have before stated, that in all machines considerable power is consumed, which must be replenished by some means or other, or the motion of such machine must ultimately cease. I will now explain how it is that this consumption of power is unavoidable.

The centre of gravity of every body is that precise point in which the whole weight of such body is, as it were, condensed or concentrated, and which will, therefore, according to the established laws of gravitation, *always have a tendency downwards*, or towards the earth. This natural tendency in all bodies to fall, renders the application of some force or support necessary, if we intend them to remain in any situation above the surface of the earth; when such support or force is discontinued, *the body will immediately fall*. This gravitating property is often taken advantage of in machinery, where wheels are made to revolve, by the gradual falling of a heavy weight: but as a body cannot be made to fall for ever, since it must, sooner or later, arrive at the earth, it becomes necessary to raise it again to the same height from which it may have fallen, in order that the motion of the machine impelled by it may be continued; and thus, in the operation of raising it, *a power greater than the weight itself to be raised, must be expended;* and unless this expenditure be renewed, the motion must cease. Friction, also, will consume a proportion of the acting power; and the atmosphere, through which a body is made to pass, will considerably retard its progress. These are the obstructions which cause that loss of power alluded to in my former letter; and the *impossibility of replenishing the acting power by any machine*, has, I trust, been already made apparent. As matter cannot set itself in motion, but requires the application of some external force to move it, it follows that *every machine* must first be acted on by some external force before it will move; and this external force is termed the acting power. If, then, it can be proved that no acting power can move perpetually by itself, it will, of course, follow, that no machine can move perpetually; for, as we cannot stop the mouth of a spring, which is the source of a river, without also stopping the progress of the river, neither can we stop the acting power, which is the source of motion of a machine, without also stopping the progress of the machine. The moving or acting power, then, of every machine having a centre of gravity, and it being necessary that this acting power should be kept constantly moving, in order to produce perpetual motion in the machine, it follows, *that the centre of gravity of such acting power must also be kept constantly moving.* Now, I will consider the centre of gravity in every possible situation, and we shall see how far it is practicable to keep it constantly moving, without the fresh application of any force beyond what was originally required to give the first impulse. When the motion of a body commences, its centre of gravity must either begin to ascend or descend, or move horizontally; for, if it remain at rest, no motion can ensue. Now, if it be intended to produce perpetual motion, *by the continual ascent of the moving power,* this is impossible, since its centre of gravity having a tendency downwards, will compel it to descend, so that the body, instead of ascending, will, to use a homely expression, fall from its own weight. If it be intended that the *moving power should descend,* it must either descend for ever, or it must first descend, and then ascend alternately. With regard to the first hypothesis, that of a body descending for ever, I have before stated, that this cannot be; and the impossibility of such a motion is so apparent, that it is unnecessary to dwell upon this point; and with regard to the second hypothesis, a few words will suffice. Provided there were no external impediments, the action and reaction of a body would be equal, so that a body would, in its descent through a certain space, acquire a sufficient momentum to drive it back again, or make it rebound to an equal height, from which it may have fallen, and this operation might be repeated again and again, *and, in short, for ever;* but, unfortunately (in this respect at least) we are not freed from the powerful influences of those impediments I have before alluded to. Friction, attraction, and the air's resistance, will all conspire to retard its progress; and the motion of the body, which will ascend to a less height every time, will at length be exhausted, and the body itself will become inert. This may easily be proved. Let any person fix a piece of wood horizontally at a certain distance from the ground, and hold a marble against the under side of the wood; on letting it fall on a flat surface of stone underneath, it will not rebound sufficiently high to touch the wood. Practically speaking, therefore, action and reaction are not equal, or rather *the whole force of the reaction cannot be made effective.* I have now only one other situation to consider the center of gravity in, namely, when it is intended that perpetual motion should be produced by an horizontal movement of the acting power, backwards and forwards. Such a body would come precisely within the laws of a pendulum, and we must all be aware that no pendulum can generate motion. The motion may for a time be prolonged by the original impulse; but the moment this is consumed by the friction, &c. *the pendulum* being *of itself unable to renew the consumed power,* the motion must cease. Should these remarks prove acceptable to you, I will follow them up, by showing how they may be applied to *machines of every description,* and will endeavour to point out the cause of the error into which so many have fallen in their attempts to discover perpetual motion.

I am, Gentlemen, yours, &c.

HENRY DEACON.

MODE OF IMITATING SEED PEARLS.

Cut silver-lace into pieces of various lengths; put them into a small crucible, with pounded charcoal; one stratum above another; give it a heat sufficient to melt the silver, which will be found, on cooling, fused into round grains resembling pearls.

COMBINATION LAWS.

Extract from the Minutes of Evidence.

(Continued from p. 11).

Mr. Richard Taylor, Printer, examined—

Has been about twenty years in business. Is of opinion that the Combination Laws are of no service at all to the employers, and that they only create greater difficulty of arrangement between the employers and the men; so much so that the last time when the letter-press compositors and printers struck for wages, the masters *unanimously* agreed that nothing should induce them to avail themselves of the Combination Laws, considering them as most unjust and oppressive, and that it would be disgraceful for them to avail themselves of them, having found that they only protracted the differences that had occurred on former occasions. There were some men imprisoned for combining a great many years ago, and that created a great deal of misunderstanding, for they were among the most respectable of the workmen. They had been entrusted by their fellow-workmen at large to negociate an advance of prices with the masters; and the inflicting of imprisonment on men thus generally respected and trusted, naturally created much ill blood; a great deal of mischief was the consequence of it. When combinations have taken place among the workmen, it has generally *been to advance the prices when bread grew dear, or the means of living advanced.* Conceives, that if all the Combination Laws were now repealed, the repeal would be attended with no disadvantage to the masters, and that a better understanding between the masters and the men would be produced. If masters and men were left at perfect freedom to make their bargains, is convinced that both parties would be more reasonable than they now are, and more likely to agree. Were masters to stand on the law as it now exists, the parties could never approach each other.

You said that the masters in your trade had resolved not to enforce the Combination Laws; were the workmen perfectly satisfied that they had no ground of fear from them?—Yes, we stated that to them.

What induced you to make that communication to them?—Because we thought the laws very abominable and unjust.

You thought it would be more for your advantage not to enforce them?—No; we thought the laws very disgraceful, and equally so, that when we were ourselves combining to reduce wages, we should have put men into prison for doing the very same thing that we were doing.

Do you not believe that the men would be more reasonable by being assured that you would not exert any authority you had over them?—Yes; we felt convinced that if we treated them with justice and generosity, we should sooner get to an end.

And you have found no effect produced on wages by your resolution, *which was tantamount to a repeal of the laws?*—No; we have had no difficulty since.

Mr. Alexander Richmond examined—

Has had a very general acquaintance with all the manufacturing districts of Scotland, a good deal in England, and in Ireland, for upwards of twenty years. Was himself first an operative weaver, afterwards a manufacturer, commission-agent, and merchant. While an operative, was principally employed at Glasgow. Was one of the committee of five workmen who conducted the proceedings for a regulation of wages in 1810-11-12, and who, on the strike that then took place, in consequence of the failure of every effort on the part of the men, to come to an amicable arrangement (the most extensive strike, perhaps, that ever occurred in this country, nearly forty thousand looms having been struck at one instant, from Aberdeen to Carlisle), were apprehended, brought to trial, and punished. The men were obliged to submit, and ever since their wages have been on the decline, till at length they receive on an average from eight to ten shillings a week for fourteen and sixteen hours of labour per day, while in 1812 the average wages were from ten to twelve shillings a week, for not more than twelve hours labour per day. Conceives that the repeal of the Combination Laws would have a tendency to reconcile the interests of the masters and workmen, between whom, throughout the whole of the manufacturing districts, a strong sentiment of division has prevailed ever since this great reduction in the wages took place; there has no longer been the same agreeable intercourse between them; a rooted antipathy, in fact, has been engendered in the minds of the labouring classes against the higher ranks, and this bitterness of feeling the repeal of the laws would have a great tendency to reduce.

You are of opinion, then, that there should be a power of combination in the men against their masters?—No; I do not say that *I should be in favour of combinations at all; what I state is, that I do not think combinations would have been so necessary, had the law virtually operated equally.**

Mr. Martineau further examined—

Combinations seldom take place, except in those branches of business where uniformity of wages for time prevails; where, for instance, a shilling is paid for six hours' labour, be the work good or bad, as is now the practice in the weaving and other trades. Among engineers, again, who are paid according to their quality, it is impossible that combinations can take place. A good workman receives in proportion higher wages to an inferior one. Apprehends no evil whatever from the repeal of the Combination Laws; on the contrary, thinks that all the evils that in the course of time they have brought on, would be ultimately done away with. Believes that in no part of the kingdom are combinations so strict and close as they are at Liverpool. The consequence there has been almost invariably that the men have obtained the ascendancy over their masters; but thinks the case would be otherwise were the Combination Laws repealed: admits, however, that it would require very skilful conduct on the part of the masters to effect the change, and that

* We are glad to have the support of a witness of so much personal experience as Mr. Richmond to the opinion we have offered on this point—[See note, p. 10.]—Edit.

it would necessarily be a work of time. In consequence of the Combination Laws having existed for a length of time, funds have been established amongst these men, on which they can subsist for some time; but thinks that the first step taken on the repeal of the acts, would be a breaking up and division of these funds.

Mr. Bryan Donkin, engineer, examined—

Has no doubt the Combination Laws tend to disturb the harmony that should exist between workmen and their employers. Believes they have served as a bond of union among the men. Strikes have been generally made with great reluctance, and chiefly where the men feel the pressure from inadequate wages. Considers every demand for a uniformity of wages unreasonable, but not so demands for wages according to the quality of workmen. Apprehends no evil whatever from the repeal of the Combination Laws. All that is requisite is, that the men and masters should be allowed to make what bargains they please, as to the amount of wages, or of working, and method of payment, provided a summary method of enforcing contracts were established.

Mr. Philip Taylor, engineer, examined—

The Combination Laws have helped the masters in no degree; and the effect of them has been to produce a bad feeling between men and masters in every trade. Expects no evil from the repeal, but much good. Has always set his face against combinations, both with regard to masters and men.* Thinks the masters generally would make better terms with the men, if the men knew that they in no degree combined against them; and, on the other hand, the masters would be in a better situation if they had no power to prevent combinations among the men. Among the master engineers and master millwrights in London and its vicinity there has been no combination for years; and this is one reason why a better feeling exists between them and their men, than between those in any other trades.

Mr. Henry Maudsley examined—

Concurs entirely with Mr. Donkin and Mr. Taylor in opinion as to the effects of the Combination Laws, and the good to be expected from their repeal.

Mr. Alexander Galloway examined—

Are the Committee to understand, that in your experience in these branches, where each man works by piece-work, or receives payment according to his talent and time, you have not known combinations to take place?—Very rare—seldom or ever: I do not think there exists such a thing; since each man has been allowed to make his own bargain, and not to be at all influenced by what his neighbours did; all combinations have ceased in those employments where that regulation governed. I will illustrate this by a case. Our business (the engineer's) is composed of six or eight different branches; workers in wood, whom we call pattern-makers, consisting of good cabinet makers, joiners, millwrights, and others employed in wood; iron and brass founders; smiths, firemen, and hammer men as they are called, vicemen and filers; and brass, iron, and wood turners in all their variety. It has been the practice in every carpenter's or joiner's shop to pay every man 30s. a week, whether good, bad, or indifferent, and they wanted to carry this same system into our employ, but we would not act upon it. I have carpenters that I give two guineas a week to; to others 36s., others 33s, and so on; nay, some at even below what an ordinary carpenter gives. We have found, therefore, that the men in our manufactories have never attempted to conspire; for every man is impressed with the idea that the moment he can work better and quicker, he will have his wages increased; But in all those manufactories where the wages are the same, it is no uncommon thing for a man to receive from his master double the wages he has earned. In the business of a millwright, for example, *all the men* have two guineas a week, and a man of that class formerly was employed to turn a grindstone, which one at 18s. a week would have done as well but the men would not allow it. The consequence has been, that engineers have become their own millwrights, and we make our machines so much better and so much cheaper, that that trade which used to scoff and spurn at the name of an engineer, are obliged to take up the name of engineer, and conduct their business by the engineer's economy.

Thinks that the greatest benefit would result from the repeal of all the laws respecting combination which now exist, both to the employers and employed. All that is necessary is to have a law obliging parties to do that which they agree to do; conceives that they should be left at perfect liberty.

(To be continued.)

EMIGRATION OF ARTIZANS.

Extracts from the Evidence

(Continued from p. 12).

A. B. Dean, esq. chairman of the customs, examined—

Is decidedly of opinion that the laws to prevent artizans leaving the kingdom to reside abroad, have not been efficient for that object. Thinks it very difficult for any officer of the customs, let him be who he may, to determine who is an artificer. Although he has known repeated emigrations both to America and to the continent, has very rarely had any evidence of the parties being artificers; they go out as husbandmen, or as people not within the contemplation of the acts. Considers that there would be no injury from removing the laws altogether.

Mr. Charles Boyd, general surveyor of the customs, London, examined—

In several instances the officers have the

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* Another testimony against the military tailor system.

covered, that artificers were about to leave the kingdom; but as the law does not prohibit artificers from leaving the kingdom, only *from going out of the kingdom to teach their trade to foreigners, or to exercise it in foreign parts*, when a man is merely suspected of being an artificer, or known to be an artificer, we conceive we have no authority to detain him, *unless we can prove for what purpose he is going abroad.* So that, in point of fact, the laws are perfectly inoperative to prevent the emigration of artificers.

(*To be continued.*)

EXPORTATION OF MACHINERY.

Extracts from the Evidence.

(Continued from p. 14).

A. B. Dean, esq. chairman of the customs, examined—

Considers the difficulties attending the strict literal execution of the laws against the exportation of machinery very great. There have been perpetual questions before the Board, how far particular articles of machinery came within the letter of the acts. The Board have always considered it their duty to look at these acts according to the letter, and not the spirit: they have felt most reluctant to put them in force. Considers the laws to be inefficient for the objects for which they were intended.

Mr. Henry St. John, comptrolling searcher of the customs, examined—

The laws which prohibit the exportation of certain kinds of machinery are not acted up to. Where any prohibited goods are discovered in the act of being exported, they are generally restored by an order of the Treasury, or by an order of the Board of Customs. The penalties are frequently waived, and the goods restored to the parties, some on a satisfaction, and some without any; in fact they are seldom condemned. The only instance of condemnation he recollects, is that of two cases containing large iron rollers, which were discovered by witness, entered as agricultural instruments, in the name of Mr. Ware. Upon the examination of Mr. Dubois (the person who attended), he said that they were especially for that purpose, and that they could be converted to no other purpose but the bruising of grain. Witness told him that he was undoubtedly of a different opinion; that they were rollers of immense power, and strictly prohibited; upon which Dubois turned on his heel, went away, and never made any farther application for them. The goods were accordingly seized, condemned at the Court of Exchequer, and sold at the king's sale. They were entered for exportation at £40, and the sum they cost was said to have been £80; but at the Custom-house sale they sold only for four pounds! Is convinced that the laws are "very often indeed" evaded in the exportation of machinery. There are vast numbers of packages opened by the Custom-house officers, where there are parts of machinery packed with other iron and steel articles from Birmingham, purposely thrown together for deception, and it is almost an impossibility for an officer to know whether they are or are not prohibited, being only parts of machinery. The steam-engine, too, which is the master-piece of all machinery, is never stopped, merely because it is not literally named in the act.

Mr. Boyd, general surveyor of the customs, examined—

Metal presses are prohibited to be exported when used with a screw exceeding an inch and a half diameter; but the machinery for making screws of all sizes (except for potters' use) may be exported freely. So also blocks for calicoes are prohibited, but not the block machinery. Many articles are mentioned in the acts as prohibited, which were formerly perhaps of great importance, but have now been superseded by improvements made since. The articles most necessary to keep in this country are in fact not prohibited by name; and as to many of those that remain in the books, it is now of no importance whether they go or not. A new machine discovered to-morrow in the cotton, linen, woollen, or silk manufacture, would be as much prohibited as any discovered fifty years ago; but in the iron and steel manufacture it is only those by name. Considers on the whole that it is extremely difficult to put into effect the laws as they now are: independently of the facility of shipping machines, there are scientific works, whose circulation extends to all parts, which supply engravings of every new machine as soon as it comes out. Doubts whether this is not almost as good as getting the machine itself.

(*To be continued.*)

MUSIC AND LIGHT.

In an article headed "Music and Light," in the Mechanic's Magazine (p. 382, Vol. I), a discovery is supposed to have been made by Dr. Buchanan, of Kentucky, of an affinity between the *seven primary colours*, as presented in the rainbow, and the *seven natural notes of music.* The same fact, however, was observed long ago by sir Isaac Newton, and has engaged the attention of many celebrated writers on natural philosophy since the period when that great discoverer flourished. Mr. Walker, in his system of Familiar Philosophy, in adverting to this phenomenon, remarks, "This wonderful conformity between musical notes and the refrangibility of light, seems as if our scale in the major key had its foundation in nature. The analogy is double; there are but seven notes in music, exclusive of interposing semitones, and there are only seven primitive colours in nature; and these colours suffer a refraction in their passage through the prism that marks the proportional distance at which a performer should place his fingers on the finger-board of his violin"—(p. 406). R. CLESANCE.

[We propose to illustrate this subject farther as soon as some explanatory diagrams which we have put into the engraver's hands are ready. We may mention, in the mean time, that this remarkable coincidence between colours and sounds induced Père Castel to write a treatise, to prove that as the *ear* finds pleasure in the succession of *sounds*, so the *eye* may have a similar one from the succession of colours. For this purpose he constructed an *ocular harpsichord*, which, instead of sounding to the ear, presented colours to the eye. The prismatic rays furnished the notes, and the shades between, were for the semitones. Thus Doctor Buchanan has also been anticipated in his "*concert for the eye.*"—EDIT.]

THE RAISED ROOF.

GENTLEMEN;—I am not surprised at my brother tradesman, the "Old Carpenter" wishing to know how a roof was constructed that would bear a pressure under the rafters in *succession*, so as to be raised without a single slate being broken. Roofs are generally so constructed, that the rafters are merely nailed on to the plates and purlins, which are framed into what are technically called the principals. The principals again are strongly framed together, and support the greater part of the weight, and also tie and hold the roof and walls together. A drawing of one of them is shown by Mr. Horsfall, at the head of his letter (page 393, Vol. I). The principals are generally placed from 8 to 10 feet apart, and the common rafters are supported by the purlins or framed timbers between each pair of principals; therefore any pressure to the under side of the rafters in *succession*, would draw out the nails, and raise the rafter above the adjoining ones, and be a certain means of breaking the slates. In short, it is clear that this mode of operation could not have the effect of raising the roof in the manner described. I have no doubt myself but that the engine or press was placed under each binder of the principals, and most probably also jointly under the wood plate, which lays upon the walls, and is hence otherwise called the wall plate, as the whole weight of the roof rests upon it. I have both raised and covered very heavy roofs and floors (but no roof so large as that of Mr. Horsfall) by means of levers and screw-jack, and it is hence easy to conceive how much greater they may be accomplished by the hydraulic press, which is not only possessed of much greater power, but requires the assistance of fewer hands.

J. W. T.

P. S.—I hope the foregoing may come under Mr. Horsfall's notice before he sends you his reply to the "Old Carpenter." If I comprehend the latter aright, it is only the expression of the rafters being raised in *succession* which puzzles him; and it is desirable that the attention of Mr. H. (who I presume is not a carpenter) should be more particularly directed to this point. Any practical information that you may procure upon the subject will be gratefully received by a great many of us.

ONE OF A KNOT OF CARPENTERS.

WATCH BALANCES.

GENTLEMEN;—Your correspondent W. G. P. (p. 443) appears to imagine, that the intention of a compensating balance is merely to counteract the effects of expansion in the balance, as in his scheme no provision is made to obviate the effects of expansion on the pendulum spring, which is greater than that on the balance. The relative influence of heat on the balance and spring may be shown by the following experiment:— Having regulated a watch with a steel balance to any given rate, observe how much it loses on that rate in a given increase of temperature: then substitute a brass balance, and regulate it (by means of that balance) to the same rate, and observe the effect produced under similar circumstances to the foregoing. If A = the whole influence of heat on the time of vibration with the steel balance, B = the influence on the steel balance above, and C = the difference of the two observations; then because the expansion of brass exceeds that of steel in the proportion of 5 to 3, B = 1⅔, C and A — B = the protracting influence of expansion on the pendulum spring. It is therefore evident, that the purpose of a compensating balance is not only to negative the effect of heat on the balance, but to compensate for the whole influence of expansion on the times of vibration. The most perfect of the various thermometrical compensations that have hitherto been invented, are still incompetent to produce the desired effect. This subject affords an ample field for the exertion of mechanical talent. I would, however, strongly recommend every speculating mechanic first to acquaint himself not only with the efforts which have at various periods and with various success been made at horological improvements, but to study thoroughly the principles upon which those effects depend; and endeavour to acquire that knowledge which will lead him to act scientifically, and shield him from the vexation and disappointment of making fruitless and laborious experiments.

I am, Gentlemen,
Your obedient servant,
R. B.

HUNT'S ROASTED CORN.

March 8.

Gentlemen;—I have been in the country working at a job, and therefore had not till yesterday an opportunity of seeing Mr. Hunt's vindication, published in No. 25 of your Magazine. When I first purchased some of Mr. Hunt's roasted corn, I read on the paper in which it was wrapped, that it was sold *only by Mr. Hunt*, and that I was to be sure to look for his signature, to imitate which was forgery. I therefore really thought that I could buy from Mr. Hunt, and no one else. I wished therefore, to tell my brother mechanics the plain truth, viz. that any one who sells roasted rye at a shilling a pound, gulls the public. This I still maintain, and will prove.

When I first wrote to you, rye only cost 4*s.* a bushel; prime rye has since risen to 5*s.* and 5*s.* and 6*d.*, at which price I bought some the other day, which weighed 56 lb. the bushel. I am quite positive as to the weight, for I have weighed it accurately. I roasted a quart in my old way, and another in the manner pointed out in No. 26 of your Magazine (by soaking it first in water), and found that in both cases it lost 5 oz. the quart, or 10 lb. the bushel, which is much more than I thought it would. This leaves 46 lbs. of roasted rye to every bushel; and here I may observe, that I cannot imagine what Mr. Hunt's "unique preparatory process, and peculiar method of roasting" can be, by which a bushel would only give "28 lbs." By my common and unscientific method, which has nothing "unique or peculiar," but which nevertheless roasts the rye admirably, 5*s.* 6*d.* produces 46 lbs. Were I to sell it for a shilling a pound, I should gain 46*s.* on every 5*s.* 6*d.*, or about 750 per cent, or 16*l.* 10*s.* on every quarter of rye. Mr. Hunt talks of his establishment, and expense for labour, &c.; but let any one compare the expense or labour of simply roasting rye to that of converting a quarter of wheat into bread. If the bakers were to make the same profit on a quarter of wheat (and why not on wheat as well as rye), the Lord only knows what would become of us poor carpenters. You say that Mr. Hunt's challenge "is quite conclusive."* It certainly is so as

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* Conclusive that he does not make 750 per cent. We are still of opinion, that as the trade in roasted grain is perfectly open, there being many hundreds of dealers in the article, and as no person is compelled to pay Mr. Hunt a shilling per pound, if he can get as good an article elsewhere, or manufacture it at home for less money, the public have no more busi

far as it regards me; for so far from being able to enter into a bond of 10,000*l.*, I could not enter into one of 100*l.*; or if I did, I could not pay it if forfeited.

Your most obedient servant,

A Journeyman Carpenter.

ENGLISH METHOD OF CASTING MEDALLIONS.

Gentlemen;—In Number 28, p. 446, a correspondent subscribing himself an "Old Caster," has attempted to explain the English method of casting medallions. He tells you that the mould is taken in plaster of Paris, and that the metal used is composed of one-fifth antimony, and the remainder lead, and this is all he says about the process. This explanation appears to me not only insufficient but calculated to mislead; for I am persuaded, if a person attempted to make a cast, and had no other guide but his explanation, his labour would be lost. I have cast many medallions, and some were very beautifully executed. Nothing certainly can be better adapted for making the mould than plaster of Paris; and metal composed of one-fifth of regulus of antimony, and the rest tea lead, is, no doubt, the best that can be used for the purpose; the metal is the same as that employed for casting types, and may be bought ready mixed. It is perhaps unnecessary to explain the manner of making the mould, that operation being so very simple; but to make a cast from the mould is by no means so easy. The method which the reading of your correspondent's explanation would naturally suggest, would be to pour the hot metal into the mould, and then leave it to cool; but a perfect cast cannot be obtained that way. I will endeavour to describe the proper method.

Procure an iron crucible, of a size corresponding to the mould to be cast; place a piece of sheet iron loosely at the bottom, a little larger than the mould; lay the mould upon it with its face downwards, having previously cut nicks in the edge for the metal to run under; upon the top of this place another piece of sheet iron, with the sides bent up to within half an inch of the top of the crucible, and put the whole in a hot place, till the mould is thoroughly dry. To prevent the iron plates and mould from rising up more than the half inch allowed, place something across the top of the crucible, leaving room to pour the metal in, which should be nearly red hot, and enough of it should be put in to cover the top piece of iron. The crucible should then be removed to a cool place, and in about a quarter of an hour the mould may be turned out. The metal being of a brittle nature, the superfluous parts may be easily knocked off, and the medallion taken out from between the two iron plates. If this method is attended to, the cast will be so perfect, that the medallion will not be distinguished from the one it was taken from.

Yours, &c.

J. D. S.

ners to call Mr. Hunt to account for his charges, than they have to inquire into any other tradesman's private concerns. Mr. Hunt will soon find out that it is *his own affair*, if he charges too much; and it seems absurd to expect that he should cease selling at a shilling a pound as long as he can find a ready market at that price. At the same time, it is not to be denied, that our correspondent, "The Journeyman Carpenter," has done an acceptable service to his brethren, by pointing out to them at how much less cost they can make as good an article at their own fire-sides.—*Edit.*

MR. GLADWELL'S SKATERS' LIFE-PRESERVER.

We have received several letters, which speak in terms of high praise of this invention [see Vol. I, p. 433]; some of them, however, suggesting improvements that are deserving of the inventor's consideration.

T. Bullen, Bath, suggests, that instead of wheels, the platform should be on slides, like a sledge, by which means the machine would rest more firmly on the ice when in the act of lifting the person from the water.

C. Bellamy recommends that there should be a small catch of wood or iron attached to the pole, to prevent it from sliding too far forward.

C. H. says, "The superficial measure of the platform is neither so broad nor so long as I should have made it, had I been so happy as to have anticipated the project, the larger the surface, the greater being the safety in the case of weak ice. The fulcrum in the centre also looks too heavy; a moveable tripod would be more secure."

INCORRECTNESS OF IRON MEASURING CHAINS.

Land-surveyors and others, who have occasion to use chains for measuring land, ought to use copper wire for the purpose; as I have proved that a chain of 60 feet long, made of iron wire, lengthened 14 inches from its being oxidized: copper does not yield the oxide as iron does.

A. BANAT.

MODE OF SOLDERING, IN THE CONSTRUCTION OF TELESCOPES.

The following is a safe and neat mode of soldering a piece of brass to the back of the little speculum of a telescope, as a fixture for the screw to adjust its axis: telescopes of any construction may be neatly put together by the same means.—Having well cleaned the parts to be soldered, cut out a piece of tin-foil, the exact size of them; then dip a feather into a pretty strong solution in water of sal-ammoniac, and rub it over the surfaces to be soldered; then place the tin-foil between them as fast as you can, for the air will quickly corrode their surfaces, so as to prevent the solder taking, and give the whole a gradual and sufficient heat to melt the tin. If the joints to be soldered have been made very flat, they will not be thicker than a hair, though the surfaces be ever so extensive.

INQUIRIES.

No. 3.—SIZING OF PAPER.

Upper Clatford.

GENTLEMEN;—It has often occurred to me when sizing paper in the tub, that some simpler method might be discovered to supersede that tedious and expensive process.

It may be necessary for the information of some of the readers of the Mechanic's Magazine, to inform them, there are two methods of sizing paper; one is called tub sizing, the other engine sizing. Tub sizing takes place after the paper has been made and dried; it is then soaked in a glutinous liquid, made from parchment cuttings, or fellmonger's pieces, which gives the paper that firmness of texture which engine-sized paper so much wants; all writing papers are sized this way: engine-sized paper is so called because the ingredients are put to the stuff in the engine before it is made into paper. The ingredients generally consist of about 1 lb. of dissolved soap, and 4 lbs. of alum to one engine (as it is called) of stuff. This method is by far the least expensive, and, in my opinion, might be brought to perfection, so as nearly, if not quite, to supersede the necessity of tub sizing. At present the greater part of the printing papers are sized this way.

If any of your correspondents could suggest any ingredients to put to the stuff (for that, I think, is the way it must be done, either with or without the soap) and alum, that will give the paper the firmness of tub-sized when dry, and not injure it in any other respect, he will cause a great expense and labour to be saved in the manufacture of this useful article. I am, Gentlemen,

Your obedient servant,

A PAPER-MAKER.

No. 4.

To the Editors of the Mechanic's Magazine,

Chatham.

GENTLEMEN;—If any of your correspondents would give a receipt for cleaning (or I should rather say whitening) leather gloves, belts, &c. which would supersede the use of that offensive article, pipe-clay, he would oblige (according to the last estimates) about 90,000 men, including your constant reader, H.

No. 5.—PROBLEM.

Cast off from a square plot of ground, a quarter of a square from one corner of the whole, and how can you divide the remaining three-quarters into four equal parts of the same *shape* and *size*? QUODLIBET.

A MODE OF DRYING DAMP WALLS.

It very often happens that apartments on the ground-floor, particularly if the house be situated near a common sewer, or other receptacle for filth, are so damp that they cannot be successfully papered; and, if papered, the paper soon moulders and decays. To remedy such an evil, the following plan is recommended in a French Journal:—"There was a large room which was always damp, and after a variety of means had been employed to render the walls dry, it was resolved to pull them down. Under these circumstances, it was recommended to wash them with sulphuric acid, which was done; the deliquescent salts were decomposed, and the room was afterwards perfectly dry."—*Chemist.*

BORING THE EARTH FOR WATER.

High-Street, Knightsbridge.

GENTLEMEN;—On perusing No. 19 of your Magazine, my attention was particularly arrested by an article under the head of Boring for Water, signed T. Edge. When speaking of the annoyance of land-springs to well-borers, Mr. E. observes, "I have bored past them to a depth of from 2 to 400 feet; in evidence of this," he says, "I can show to any person wells bored 12 months ago that cast up from 10 to 50 gallons of excellent and remarkably pure water." Time is not specified; but he goes on and says—"To instance a few wells thus bored, there is one on the coach-road side at Tooting; another on the premises of Mr. Rollisson; three on the estate of the Rev. R. Cranmer, Mitcham; one for Messrs. Holden, Mitcham." Mr. E. also mentions wells bored at Merton (which I apprehend to be the one at Mr. Johnson's) and at the copper-mills. Now, all these wells were bored by myself, though by the way in which Mr. E. expresses himself, it would seem as if he were the person by whom they were executed.

Again—Mr. E. observes, respecting those wells at Merton, that "they each cast up at least 50 gallons of water per minute." The fact is, that each of them casts up upwards of 200 gallons of water per minute. The one on the coach-road side at Tooting casts up nearly 100 gallons per minute.

Sir, your obliged humble servant,

JOHN GOODE,

Original Well-Borer & Patentee.

[We are convinced that Mr. Edge had no intention of arrogating to himself the credit due to Mr. Goode, who seems to us to infer from Mr. E.'s words more than they fairly warrant.—EDIT.]

DISCOVERIES AND IMPROVEMENTS.

TALLOW CHANDLERS' BOILERS RENDERED INNOXIOUS.

Mr. Henry Fothergill, of Benwell Colliery, in Northumberland, has lately invented a simple and ingenious mode of erecting tallow chandlers' boilers, by which the offensive effluvia so much complained of by those in their neighbourhood is completely destroyed; and the workshop, being entirely cleared of the vapour from the kettle, is also rendered more cool and comfortable. The boiler is erected in such a way, that the fire is made to surround it equally on the outside, beneath the surface, and the fire is supplied with atmospheric air only from above, the ash-pit being wholly closed up by an iron moveable plate. The tube or chimney is so constructed as to make the foul vapour pass downwards, and through the fire, where it is completely consumed. The prominent advantages of Mr. Fothergill's valuable invention are, 1. A saving of about one-half of the fuel used on the old plan; 2. A considerable saving of time in the melting process, and also in the hardening of the dips, the workshop being, on this plan, cleared of the heated vapour; and 3. Ridding the neighbourhood of these melting-houses of the nuisance continually complained of, arising from the offensive effluvia, and for which the proprietors are always liable to be indicted.

Mr. Fothergill has already erected several boilers in Newcastle and the neighbourhood for some of the principal tallow chandlers, who have expressed great satisfaction at the many advantages they derive from the invention.

BOOK-GILDING.

John Robertson, bookbinder in Montrose, has invented a machine for gilding books on the back. It performs its operation with great accuracy and quickness, enabling the gilder to finish fifty uniform volumes in the course of an hour. It works by weight, receives the necessary temperature from hot sand, and can be employed about thirty-five minutes with the heat that is thus given. He calls it a weight pullet, from a tool of that name, used for the same purpose.

CHINESE SIZE AND VARNISH COLOURS.

We noticed before (p. 108, Vol. I) the introduction into this country of the Chinese size and varnish colours, by a painter at Edinburgh, named Macglashan. He styles himself, "The sole proprietor of the receipt," for making them in Britain; and we must therefore, we presume, rest content with its remaining for some time yet a secret. The properties of these colours, as we find them last recapitulated, are as follow: "The size colours are of a brighter appearance, and will stand much longer than those now in use, and they will clean when soiled; and a hundred yards can be finished, dry and free from smell, in a few hours, at the expense of a little more than one pound. The Chinese varnish colours dry in eight hours (some colours in one hour); they have a most exquisite polish, and when soiled, are not liable to be hurt by washing, as they always retain their glossy appearance. A room, of 150 yards, can positively be coated, dry, and occupied in 24 hours, at the same expense as common oil paint."

IMPROVED METHOD OF TANNING.

Dr. H. H. Hayden, of Baltimore, is said to have discovered a valuable improvement in the art of tanning, by means of a pyroligneous preparation. By his method, raw hides, after hairing and baiting, are converted into leather in less than thirty hours.

HOW TO GIVE SILVER PLATE A LUSTRE.

Dissolve alum in a strong lye; scum it carefully; then mix it with soap, and wash your silver utensils with it, using a linen rag.

NEW PATENTS.

To John White, of the New Road, Mary-le-Bone, architect; for a Floating Breakwater.—15th January, 1824.

To William Gutteridge, of Dean-street, musician and land-surveyor; for certain improvements on the Clarionet.—19th January, 1824.

To George Pollard, of Rupert-street, St. James's, brass-founder; for certain improvements on Machines or Machinery for Levigating or Grinding Colours used in the various branches of painting, which machinery may be worked by any suitable power, and is applicable to other useful purposes.—19th January, 1824.

To James Russel, of Wednesbury, gas-tube manufacturer; for an improvement in the manufacture of Tubes for Gas and other purposes.—19th January, 1824.

To Simeon Broadmeadow, of Abergavenny, civil engineer; for a new and improved method of manufacturing and purifying Inflammable Gases, by the admission and admixture of Atmospheric Air.—19th January, 1824.

TO CORRESPONDENTS.

We shall be happy to receive a continuation of W. K. S.'s favours on the condition proposed. His initials will suffice.

P. Lawson and other inquirers after the address of Mr. Cole, the patentee of the spiral spring bandages (noticed p. 426, Vol. I) are informed, that he resides at No. 1, London Bridge, Thames Street.

The "Arithmetical Question" has been already sufficiently discussed; otherwise Mr. Johnson's smart paper would have had a place.

Communications on the Cube Root under consideration, from Z.—D. W. B.—P. Mathews—R. Stone, and the original proposer of the question.

Communications received from Philosophus—W. H.—Mr. Furnival—A Plain Englishman—$\frac{7 \times 13}{26}$—Philo-Mechanicus—R. C.—A Constant Subscriber—A Young Mechanic—Kent—P. Vanryde—J. R., Long Acre—J. J., Dartford—and Tapsa.

Communications (post paid) to be addressed to the Editors, at the Publishers.

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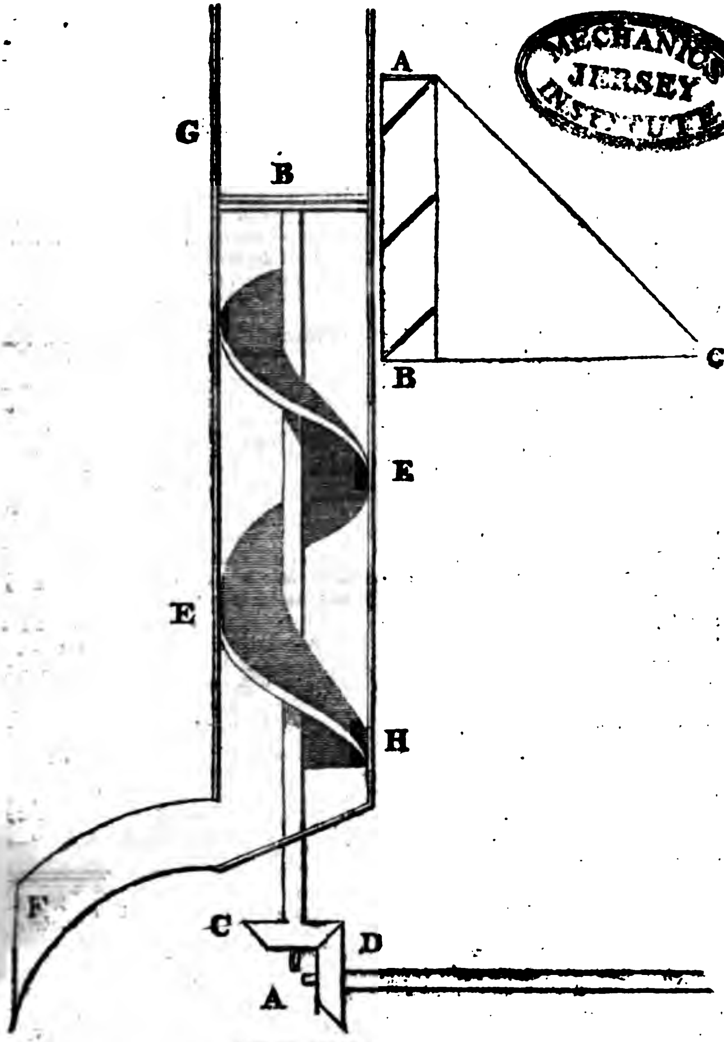
Do not hover always on the surface of things, nor take up suddenly with false appearances; but penetrate into the depth of matters, as far as time and circumstances allow, especially on those things which relate to your profession.—*Watts, on the Understanding.*

No. 31. SATURDAY, MARCH 27, 1824. [Price 3d.



NEW SPIRAL WHEEL.

NEW SPIRAL WHEEL.

Red-Lion Street, Clerkenwell,
March, 1824.

GENTLEMEN;—In your 22nd Number "A Miller in the Mountains" wishes to know how the most can be made of a fall of water. I have attempted a contrivance, which, although novel in its appearance, yet nevertheless will be found to possess a very considerable share of mechanical energy when acted upon by a fall of water, equal to that of the "Miller's." A B in the prefixed figure, represents the axis of the wheel; E E its spiral floats; G H the main, which conveys the water to the wheel; F a trough for the water, making its discharge after its action upon the wheel; C and D are two conical wheels for changing the direction of the motion from vertical circular to horizontal circular.

But as a thing in perspective only is apt to please the eye, while it deceives the judgment, it may not be amiss to enter into an investigation as to the mechanical construction and results of this curious wheel. The first part of the inquiry, then, very naturally leads us to consider the shape and magnitude of the main G H. Now, it is well known, that all bodies freely acted upon by gravity, are uniformly accelerated in their descent; consequently, since the water in its descent is moving faster and faster, the pipe or main ought to become smaller and smaller, so as to accommodate itself to the water; hence the several areas of the column of fluid will be inversely as the different velocities. Now, the velocity of any falling body is always as the square root of the depth of descent; so also the velocity of the water in any part of the main will be as the square root of the depth; consequently the areas are inversely as the square roots of the depth.

Then, let A = the area of the main at bottom; B = the height of the main, as measured from A; C = the depth of any part of the pipe, measured from the top; D = the horizontal area of the pipe at the depth C.

Then, from what has been stated, it is manifest that $\frac{D}{A} = \frac{\sqrt{B}}{\sqrt{C}}$; consequently $D = A\sqrt{\frac{B}{C}}$, it being found the proportion existing between the bottom and top of the main, must be agreeable to the conditions of the equation, otherwise the water will not flow smoothly.

Let us now inquire into the initial velocity and force of the wheel; and, in addition to the former notation, let E = the distance between the spirals; F = the number of their circumvolutions; G = the force of gravity; H = the weight of a cubic foot of water.

Then is $\frac{\sqrt{2\,G\,B}}{E}$ = the number of revolutions per second, which, if the fall were 300 feet, and the distance between the spirals 2 feet, it would be nearly 69·5 revolutions. Now, for the force acting upon the floats: as this inquiry, however, is seemingly the most difficult to those unacquainted with the principles of mechanical science, it will be previously necessary to take notice of a few particulars upon which the calculation depends. We desire not to rank among those who are fond of clothing their deductions in a mystical garb, and sending them forth as so many oracles; for, as our excellent friend, Dr. Birkbeck, has told us (Vol. I, p. 179) although the august Temple of Science has generally been represented to be situated on a rugged mountain, accessible only by thorny paths to the privileged few, yet it ought really to be considered as situated upon a widely extended plain, approachable with ease in all possible directions, and opening innumerable doors for the admission of its votaries.

Let A B C [see the prefixed engraving] be a right angled triangle, and A B a cylinder: now, if this triangle be wrapped round the cylinder, its hypothenuse will trace the helices or threads of a screw. And if a spherical body were to roll down upon this screw, it would have the same velocity and momentum as if it had rolled down the inclined plane A C (abstracting the idea of the centrifugal force which would be created); and to raise or let down a body by such a screw, would be the same as if that body were lowered or raised upon the inclined plane A C. Hence, our spiral wheel may be considered in the light of an inclined plane, whose height is equal to E, and base equal to *as many times* as the convolutions of the cylinder $=$ F.

Now, it is pretty generally known, or at least it requires little judgment to understand, what power is required to take up or let down any spherical body on an inclined plane. As the length of that plane is to its height, so is the weight to the power. This being clearly understood, the difficulty in this case instantly vanishes.

It is manifest, then, that A B H is the weight of the whole column of water in the main; consequently $\frac{E\,A\,B\,H}{\sqrt{E^2+F^2}} = N$, the power necessary to support A B H, or to allow it to slide down (if we may use such an expression), if the wheel were immoveable; but since it is at liberty to revolve on its axis, the force acting upon it will be A B H $-$ N $=$ the force of the wheel; for it is evident, that if we push a body up an inclined plane, whose weight is 24, with a force equal to 18, the remaining 6 must necessarily rest upon that plane; and if it is at liberty to move, it will do so with a force equal to 6. Every body knows that it requires no force to move a sphere on a horizontal plane, when once its inertia is overcome, and no one will deny that its whole weight rests upon that plane. If B $=$ 300 feet; A $=$ 36 inches, or nearly 6·8 in diameter; H $=$ 62·5 pounds; and E $=$ F; then the force of the wheel would be equal to 1372 pounds. It must be allowed, indeed, that this is an extreme case.

I am of opinion that F ought always to be less than E.

Perhaps the "Miller" may not altogether be satisfied with the physiognomy of an algebraic page, but my motive for doing so was with a view to convey the formula in a general form; however, I shall add a few practical rules for ordinary use.

Divide the square root of the whole height by the square root of any assumed height of the main, as measured from the top. Multiply this quotient by the area of the main at bottom, and the product will be the area of the pipe at the assumed depth. Multiply the whole length of the pipe by 64·3, and extract the square root of the product; divide this sum by the distance between the spirals, and the quotient will be the velocity or revolution per second. Multiply together the whole height of the main, its area at bottom in feet, and the distance between the spirals, and this again by 62·5; then square the distance between the spirals, and add it to the square of the like number of convolutions; extract the square root of this sum, and divide the former sum by it. The quotient arising from this division being deducted from the continued product of the whole height of the main, multiplied by its area at bottom, in feet, and this again by 62·5 will determine the mechanical energy of the wheel. I have always been of opinion, that a wheel of this kind would be better adapted for steam-boats than the common paddle-wheels, for the following reasons:—

1st. The paddle-wheels make a very disagreeable noise.

2nd. They communicate a continued tremulous motion to the vessel.

3rd. They destroy a very great quantity of power to no purpose, from their oblique action to the line of motion of the vessel.

4th. They are not adapted f...

inland navigation, owing to their destroying the canal embankments.

5th. Any body coming in contact with them is certain destruction to it.

Now, all these bad qualities I feel confident would be very much mitigated by the adoption of the spiral wheel, and these hints I hope will not be lost upon your readers.

Although there is a considerable quantity of power lost in this machine from the oblique action of the floats, yet this may, in a great measure, be recovered, by extending the floats to a greater number of convolutions; for, owing to the rapid motion of the water, there can be *no time* for any pressure acting on the under-sides of these floats, so as to balance the force acting upon their upper surface.

I am aware that in my attempt to simplify this subject, I must necessarily subject myself to the fiery ordeal of the more strict inquirer. However, your correspondent in the "Mountains" will, upon trial, find that the deductions are not very distant from the truth.

I remain, Gentlemen,

Your very humble servant,

J. Y.

ANALYSIS OF CONTEMPORARY SCIENTIFIC JOURNALS.

(Continued regularly).

Philosophical Magazine and Journal, *Nos. CCCIX. & CCCX. for January and February*, 1824.

Pressure Gauges. — The ordinary mode of ascertaining the exact pressure of highly condensed gases, is by the rising of a column of mercury in a glass tube, hermetically sealed at the top, the tube being previously filled with air at the ordinary pressure of the atmosphere; for as the mercury rises by the pressure of the gas, the air confined in the tube above the surface of the mercury, will always be compressed to the same degree as the gas itself, making proper allowance for the weight of the column of mercury. The only inconvenience attending this method, arises from the length of which it is necessary to have the tube, where gases are compressed to from thirty to forty atmospheres. To remedy this, we have here two improved gauges, proposed to us by Mr. S. Seaward and Mr. Henry Russel, who have already figured (we believe) in our pages as antagonists [see pp. 232, 246, 263, Vol. I.] of considerable ingenuity, but of somewhat irascible tempers. Mr. Russel makes no scruple of affirming that his gauge "will ultimately be considered as remarkable for its accuracy and simplicity, as Mr. Seaward's will for its inaccuracy and complexity." For ourselves, we think that the advantage, in point of simplicity, must be conceded to Mr. Russel's invention; but though Mr. Seaward's gauge is certainly of most faulty complexity, Mr. R. has failed in proving its inaccuracy. We have no doubt that both gauges will be found accurate enough for practical purposes; nor would Mr. R. have lessened his claims to respect, by limiting his asserted superiority to the greater simplicity merely of his instrument. The gauge invented by Mr. Russel is described by him to consist of a glass tube, sealed at one end, with a ball blown very near the other, leaving only as much tube beyond the ball as may be necessary for connecting it with the pipe leading from the vessel, containing the condensed gas, steam, or other vapour. This ball, when the tube is filled with air, and subject only to atmospheric pressure, should be about three quarters full of mercury, and its whole capacity need not exceed that of the tubes more than as two to one. That the divisions on the scale may be in geometrical progression, the tube is placed in a horizontal position. To determine the degree of pressure at any given point, ascertain the distance of that point from the sealed end of the tube, and by that measure divide the length of tube contained between the sealed end and the bulb; the quotient will be the number of atmospheres. Thus, suppose the tube eight feet long, and the column of air compressed into half that length, then we have $\frac{8}{4} = 2$ atmospheres. If this column be again compressed into half its volume, we have $\frac{8}{1} = 8$ atmospheres. If, again (8 feet = 96 inches) $\frac{96}{6} = 16$ atmospheres. And lastly, $\frac{96}{3} = 32$ atmospheres, which is the density at which the Portable Gas Company engage to supply their customers. For the internal diameter of the tube Mr. Russel considers $\frac{1}{8}$ of an inch sufficient.

Effect of Mercurial Vapours.—It has long been known that persons employed in the mines whence mercury is procured, as well as those who are occupied in gilding and plating, suffer paralytic and other constitutional affections from inhaling the air saturated with mercurial vapours. [We invite attention to the Safety Mask recommended in a subsequent page.—Edit.] An event which occurred in one of our ships of the line at Cadiz, in 1820, has afforded Dr. Burnet, one of the medical commissioners of the navy, an opportunity of illustrating this subject on a very extensive scale, in a paper read before the Royal Society, and here reprinted from their Transactions. The Triumph, of 74 guns, arrived in the harbour of Cadiz, in February 1820; and in the following March, a Spanish vessel, laden with quicksilver from the mines in South America, having been driven on shore in a gale of wind, and wrecked under the batteries then in possession of the French, the boats of this ship were sent to her assistance, by which means about 130 tons of the quicksilver were saved and carried on board the Triumph, when the boxes containing it were principally stowed in the bread-room. The mercury, it appears, was first confined in bladders, the bladders in small barrels, and the barrels in boxes. The bladders, however, having been wetted in the removal from the wreck, soon rolled, and the mercury, to the amount of several tons, was speedily diffused through the ship. The effect of this accident was quickly seen. In the space of three weeks, two hundred men were ill with ulcerations of the mouth, partial paralysis in many instances, and bowel complaints; and, ultimately, there was not an individual on board who was not more or less affected. Almost all the live stock too, consisting of sheep, pigs, goats, and poultry, were killed by it; mice, cats, a dog, and even a canary bird, shared the same fate, though the food of the last was kept in a bottle closely corked up; mice would frequently come into the ward-room, leap up to some height, and fall dead on the deck. Fortunately, only two out of the large number of the ship's company affected by the mercury, died. Various opinions were entertained of the manner in which the systems of the sufferers were brought under the influence of the mercury. By some it was supposed to have originated from the use of the bread and other provisions with which the mercury was supposed to have mixed itself; and the Victualling Office actually condemned 7,940 lbs. of biscuit, as unserviceable on this account. Mr. Plowman, the surgeon of the ship, and Dr. Burnet agree, however, in opinion that the ailments were produced by the inhaling of the mercurialized atmosphere. The quicksilver, being then in the most perfect state of division, was readily taken up by the absorbents of the lungs, and soon showed its influence on the system generally. The opinion of these gentlemen is fully confirmed by the fact that many fresh cases occurred after the ship had been completely cleared of the provisions supposed to be infected.

Geological Observations. — "Remarks on the Position of the Upper Marine Formation exhibited in the Cliffs on the North-East Coast of Norfolk, by Mr. Richard Taylor, of Norwich," will be found a valuable contribution to the geology of that district. On a former occasion (p. 389, Vol. I) we endeavoured to explain to our readers in what the value of geological science consists; and we are now, by the kindness of a correspondent, enabled to add a striking instance of the practical uses to which the gener[al] results furnished by this science may be applied. Mr. Smith, well known for his successful cultivation of geological pursuits, has been recently giving lectures on the subject at York, and, after enumerating all the known mineral products of Yorkshire, he proceeded to show, from the order of the strata of that county, that there were many others which, having been found in other parts of England under similar circumstances, might be reasonably expected there. For instance, he thought there was every reason to conclude that fine brick, clay, and glass-grinders' sand will be found in Holderness; soft chalky free-stone in the Wolds; white glass, sand, and fullers' earth in the strata beneath the chalk, and that even rock-salt may be found by borings in the red marl and gypsum of the vale of York, as it was discovered in a similar stratum, and by the same means, in Cheshire.

Manufacturing Salts by Evaporation on Faggots.—Mr. Bakewell's Travels in the Tarentaise, &c. have furnished a most interesting description of the Salt Works at Montiers, "perhaps the best conducted of any in Europe, with respect to economy." Nearly three millions of pounds of salts (comprising, however, not only common salt, but Glauber's salts, and the alkaline salts sold to the glass manufacturers) are extracted annually from a stream of water, which would scarcely be noticed, except for medical purposes, in any other country. The waters of Montiers, too, have only half the strength of sea water. It may seem extraordinary that water of this quality should repay the expense of evaporation; but the process by which it is effected is so simple, ingenious, and economical, that Mr. Bakewell thinks it may be even introduced with advantage on many parts of our own coast, should the salt duty be entirely removed. The process is that of evaporation by faggots—a process which, though often mentioned by English writers, is so little known, that it has been recently gravely described as consisting in throwing salt water upon burning faggots, and gathering the salt that remained! Water so weakly impregnated with salt as to contain only one pound and a half in every thirteen gallons, could not repay the expense of evaporation *by fuel* in any country. The evaporation by faggots is entirely an atmospheric process. At Montiers there are four evaporating houses, called Maisons d'Epines (literally, houses of thorns), and which are little else than large wooden frames, open at top and at the sides, filled with double rows of faggots of black-thorn. The water is poured in gentle streams, from numerous conduits at the top of these houses, upon the faggots; as it trickles through, a portion of the sulphate of lime is deposited in incrustations on the twigs, and in its concentrated state, the water is received into troughs placed at the bottom. The first two houses concentrate the water to about three degrees of strength; in the third it is concentrated to the strength of twelve per cent, that is, reduced to about one-seventh of the original quantity. In the fourth it is farther concentrated, till it nearly reaches the point of saturation, when it passes a large building, where are the pans for boiling, and where the salt is crystalized in the usual method. Mr. Bakewell's description (to which we must refer for more minute details) is so complete, that it may enable any person to erect similar works in this country.

Superior White Copper.—A paper from Schweigger's Journal, by C. Keferstein, gives an interesting account of a white copper which has for a considerable period been made and manufactured at Suhl, in the Duchy of Saxe Hildburghausen, and employed for the mounting of guns or firelocks, as also for spurs, and similar articles. This metal strongly resembles silver, even to deception, keeps excellently without tarnishing, is not brittle, but, on the contrary, extremely malleable, and contains no arsenic, like the metallic compound usually called white copper. The following are its component parts:—

Copper	88,000
Nickel	8,753
Sulphur, with a little Antimony	0,750
Silex, Clay, and Iron	1,750
	99,253

"It is now about eighty years ago since this metal was first observed, and came into use; but the source of it has become so exhausted, that at present little is found, and a pound of the slag containing it, fetches as much as two dollars Prussian currency. Mr. Keferstein considers it to be a similar alloy to the *packfong* or *tutenag* of China, and recommends that experiments should be instituted with the view of ascertaining whether a compound calculated to be of such value in the arts, cannot be artificially produced.

PICKERING'S STEAM-ENGINE BOILER.

To the Editors of the Mechanic's Magazine.

London, March 20, 1824.

GENTLEMEN;—Observing in your Number of the 13th of March a plan and description of a new Steam-Engine Boiler, communicated by Mr. Pickering, I am anxious, on behalf of a friend, to call that gentleman's attention to a fact of which I should suppose he cannot be apprized.

For the purpose of preventing any possible dispute or litigation, I beg to refer Mr. Pickering to the *Repertory of Arts* for January last, wherein he will find a *specification* of Smith's Patent Steam Boiler, and also an *announcement* of a Patent for a new Steam-Engine Boiler, both constructed on the same principles as the boiler which your correspondent describes as his own peculiar and original invention. I shall only add, that Smith's patent (assigned to my friend, Mr. Furnival) has been for some time in actual and successful operation, by Furnival, Fowler, and Co. for the purpose of evaporating Salt at Droitwich, in Worcestershire, and no doubt is entertained of its being equally applicable to many other similar purposes, as well as to the still-more important one of steam-engines. I hand you a plan of the Salt-Pan and Boiler, as a specimen of the invention; and soliciting, in justice to the parties interested, an insertion of this article in an early Number, I am, Gentlemen,

Yours, respectfully,

J. P. FOWLER.

[The plan transmitted with this letter is in the hands of our draughtsman, and as soon as engraved, will be inserted, with a description.—*Edit.*]

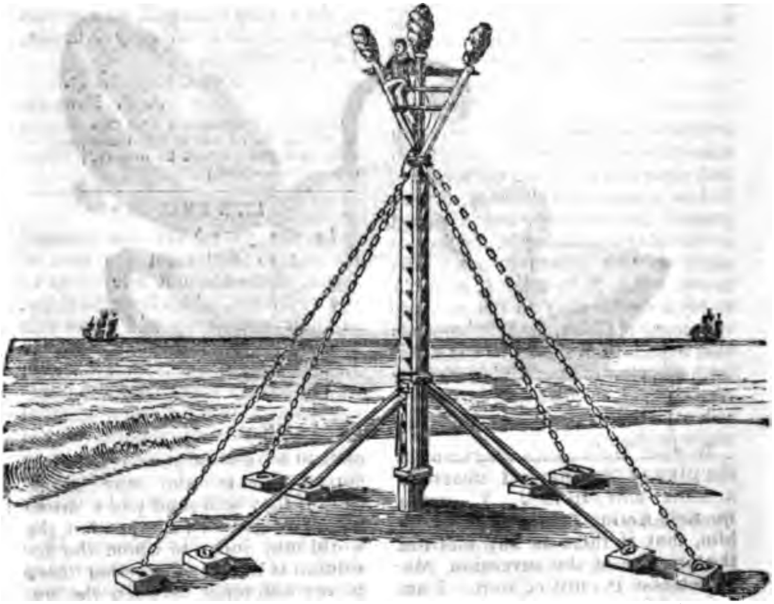
LIFE BEACON.*

In the year 1812 the channel leading to and from the port of Lynn, altered about five miles to the westward, which brought ships, in their course up and down this navigation, near a sand called the Long Sand, which is very steep, and about six miles from the nearest shore. This caused a general wish from the shipmasters of the port to have a beacon placed upon this sand, if possible, and the corporation of Lynn agreed to defray the expense of erecting it.

In July 1820 Mr. George Holditch, keeper of the buoys and beacons of the port of Lynn, succeeded in erecting the beacon, a drawing of which is given in the following page. The main piece is a tree of English oak of the best quality, 27 feet long, and 12 inches square, shod with iron for four feet, and for five feet above filled close with scuppers (short large-headed nails). It was bound round at the upper end with three strong iron hoops, to prevent it from splitting; and being thus prepared, was driven about sixteen feet into the sand, by means of a crane and beetle of thirteen hundred weight.

The topmast is made of a good red wood spar, thirty-seven feet long, and tapering off from twelve inches diameter at the base, to six and a half inches diameter at the top. It is secured to the main piece by two stout iron clasps and screw-bolts; and to the upper of these clasps are fixed four rings or eyes, to which are attached as many bars of iron, one and a half inch square, and twenty-eight feet long. The lower end of each bar is bolted to a flat block of stone,

* From the Transactions of the Society of Arts.

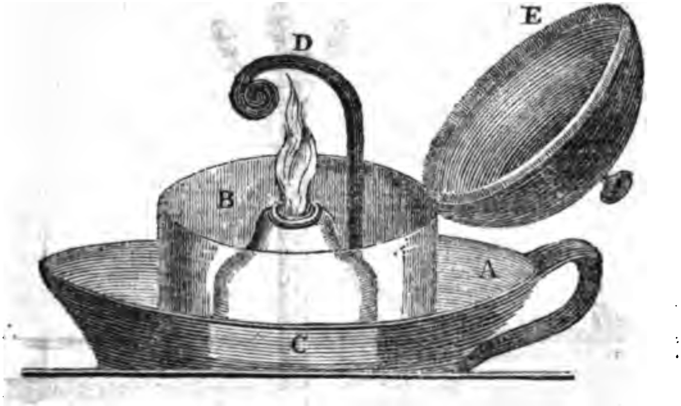


weighing six hundred weight. The stone is buried in the sand, and so firmly embedded by the tremulous motion impressed by the sea on the shaft, that it would form a secure mooring for a vessel of 100 tons. A similar iron clasp, with eye-bolts, is fixed round the topmast, about eight feet from its summit, and to this are attached four chains, each having a block of stone, of four hundred weight, at the other end. These stones have become buried in the sand, so as to keep the chains in a state of tension, and consequently give additional support to the beacon. Just above the upper clasp are three short spars, forming an inverted triangle, for the purpose of supporting more firmly the seats which are fixed to the topmast, each piece being terminated by a head of light basket-work, in order to render the beacon more conspicuous. From the seats down to the bottom of the shafts are cleats, by which, with the assistance of a chain for a main rope, a sailor or other person may easily ascend to the top of the beacon.

The beacon is erected on the highest part of the Long Sand, so that even in thick weather persons who may be upon the sand will naturally, as the water rises, be directed to it. Nor is this matter of mere speculation; for, three weeks after it was erected, two men belonging to his majesty's surveying brig, Protector, lost their way in a fog on this very sand, and were preserved by retreating before the advancing tide, till they arrived at the beacon. The distance from which it is visible in clear weather without a glass, is about seven miles.

Mr. Holditch was deservedly rewarded for this communication by the Society of Arts' Silver Medal and Ten Guineas.

The obvious utility of erecting beacons of this description on islands and banks of sand, which are covered at high water, will, we trust, recommend them to general adoption. The expense of erecting one on a sand like the Long Sand, seven feet above low water-mark, is about eighty pounds.



KING'S IMPROVED OIL LAMP.

In your Mechanic's Magazine of the 21st of February, I observed a short note from J. Y., upon the Self-Acting Lamp. I agree with him, that if there is any merit in the priority of the invention, Mr. Shoemaker is entitled to it. I am induced, by a similar feeling, to send you a drawing of a lamp in the possession of Mr. Edward Johnson, of Mile-end-road, which was made for him about twenty-two years back, by a tinman of the name of King (as may be seen by the words "W. R. W. King's Pattern," which are cast in the burner), and which, if I am not greatly mistaken, is constructed on the very same principle as that for which Major Cochrane has recently obtained a patent.

A represents the outer pan of the box-lamp; B, the inner pan; C, the metal burner, cast solid, with a hole in the centre for the wick; D, the wire cast in the burner, of sufficient length to be brought over the flame, which, having contracted heat, communicates the same to the burner, thereby keeping the animal matter &c. in a liquid state; E, the cover to keep out dust, &c. when the lamp is not in use.

This lamp was intended to burn animal fat, cocoa-nut oil, or any other material which may be apt to congeal. I should feel highly obliged by any of your readers or correspondents who may notice this, if they will send you a drawing of Major C.'s lamp, that the world may judge to whom the invention is due, and whether there is any difference between the *tinman's pattern* and the major's *patent*, that he who is justly entitled to the merit of the invention, may shake hands with Mr. Shoemaker.

Q IN A CORNER.

MORAL CONDITION OF THE WORKING CLASSES.

We have resolved to make a pause for one week in our continuations of the evidence on the Combination Laws, Emigration of Artisans, and Exportation of Machinery, in order to bring together a number of facts and observations, respecting the moral and intellectual condition of the working classes. which have been incidentally elicited from the different witnesses examined, and which, though they do not bear directly on any of the three principal questions, have still a demonstrable connection with all of them, and have only been passed over for the moment, that they might be now presented in a more single and prominent point of view to the attention of our readers.

Mr. DONKIN examined—

Considers the characters of the men who

may be properly called mechanics, much improved, and that they are now a very respectable class of persons; not one in a hundred are now habitual drunkards. With the majority, every opportunity of acquiring scientific knowledge is seized with avidity. The moral state of the workmen at present is, in short, much superior to any thing witness has known before. Has been in the (engineering) business thirty years, and has seen great improvements. He has now men who have been with him for twenty years, on whom he can place the strongest reliance. Conceives that this improved state of the mechanics is attributable to a better education; they have become better informed on the subject of moral obligations and social duties, less fickle in their motives, and more attentive to their engagements.

Mr. TIMOTHY BRAMAH mentions, as proof of the material improvement in the character of the working classes, that about twenty years ago there were in his manufactory a dozen men given to drinking, whereas there is not at present, out of a hundred men, one given to that vice habitually.

Mr. PHILIP TAYLOR agrees entirely with Mr. Donkin and Mr. Bramah on the points spoken to by them. States further, that many of the improvements in machines are actually suggested by the workmen themselves; that almost invariably they belong to benefit clubs, some of which are unquestionably well organized and managed; that the rules and regulations of these clubs, as far as he has had an opportunity of looking into them, tend to produce not only economical habits, but moral conduct; that the mechanics of the present day are averse to associate with those who are addicted to either drunkenness or swearing, having, in short, become more rational.

Mr. GALLOWAY considers, from his recollection of artizans or mechanics generally, within the last thirty years, that they are decidedly improved, not only in knowledge, but in conduct. Allows no obscene or vulgar language in his manufactory. The men themselves fine those who behave improperly; and their general character has improved. Has invariably found that the men who are best educated have always been the men who have behaved themselves the best, and who have most completely conformed to the regulations of the factory; that the *ignorant* have been invariably retractory, mulish, obstinate, and difficult to manage. Considerable anxiety has been manifested by them for scientific knowledge, in order to forward them in the labours they have to perform. Knows that there has been a greater disposition to save money, on the part of artizans, by depositing in saving banks than formerly existed. In fact, they are improved generally in their conduct; they are more cleanly and better dressed; their manners are altogether improved, and they are less given to intoxication than they used to be; they are decidedly better men.

Mr. PLACE* examined—

Do the town or delegates take any notice of the moral conduct of the flints (men who work by the day, and receive all the same wages)?—No; but if the question is intended to lead to an opinion as to their moral conduct, I should say they, like all other journeymen, are greatly improved in morals. Twenty years ago, few tailors' shops were without a bottle of gin; the men drank as they liked; one kept the score, and the publican came at certain times to replenish the gin-bottle. I suppose there is not a shop in London that has one now.

Mr. MAUDSLEY's evidence is rather of a contrary tendency to that of any of the preceding witnesses. He has "no hesitation in saying, there are *less* (fewer) drunken men in the manufactories *abroad* than *in England*." Mr. M. was, indeed, immediately well met by an observation from Mr. Donkin, that "the general character he heard of them (the foreign workmen) was, that they were *very indolent*." It must be allowed, that frequent excesses are more commonly the characteristic of habitual industry, than indolence and sobriety are the companions of worth and genius. Still, however, we see no necessary connection between industry, and intemperance however intermittent; and therefore, the sooner English workmen can leave Mr. Maudsley no room to place those of the continent above them in this respect, the better.

Mr. RICHARD TAYLOR considers the general state of morals amongst the workmen in his trade (printing) very much im-

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* We are scarcely sorry to learn, from several correspondents, that we have given serious offence to this witness and his friends, by a certain phrase in our last two Numbers. If persons will be offended at such trifles, they deserve to be put in a passion ten times a day at least. Had those who quarrel with our phraseology been as caring about things as words, they would have perceived that when we spoke of *military tailors*, we meditated no *personal* or *individual allusion*, but referred generally to that "all but *military system*" to which Mr. Place represents the whole body of journeymen tailors in London to be now subject. Had the fraternity so enthralled, consisted of hatters or shoemakers, or any other class of workmen, our language would have been precisely the same—"It is these military *hatters* or *shoemakers*, &c. (as the case might be) who have undone you." But why (in any point of view) should the title of *military tailor* offend Mr. Place and his friends? Do they imagine that it is any disgrace to have once belonged to an industrious, honourable, and worthy body of men? By-and-by we shall have a good deal more to say of Mr. Place and his preposterous schemes for bettering the condition of the working classes.—R.

proved. When he was an apprentice, a printing-office was like a public house on a Monday, and now we have no drinking at all. When a man's conduct is very bad, he gets no work. Even the workmen themselves will give a hint to their master that such a man is not fit to come into an office; that his conduct would be equally disadvantageous to the master and the men.

The evidence which we have hitherto extracted, may be considered as descriptive chiefly of London workmen, and these of the better classes, such as engineers, printers, &c. The picture which is given by other witnesses of the condition of the cotton spinners in the north of England, and in Scotland, is of a very opposite description—

Mr. ALEXANDER RICHMOND states, that the effect (in the cotton trade) of that absolute ascendancy which the masters have obtained (as stated in our last No. p 24), has been, that the price of labour has been reduced to the lowest scale that would afford a subsistence—a mere existence. Demoralization has been uniformly found to keep pace with that depression; and in some of the districts very nearly similar effects have been produced by it, as have operated for a length of time upon the peasantry of Ireland. In those trades where there is a redundancy of workmen, the masters have them almost entirely in their power, and it is those professions where the price of labour has been farthest reduced, and with the greatest rapidity. The cotton manufacture was the first in this country that had no restrictions upon the number of hands admitted into it; and the consequence has been an extension of that trade with a degree of rapidity unequalled by any other in the country. But the wages of the workmen have at the same time been so reduced, that cotton goods now sell at the price which some years ago was paid for the labour only. Thinks that, on the average, cotton fabrics could easily afford an advance of from fifteen to twenty per cent on the price of labour, without materially affecting the consumption. It is the individual competition of the masters that prevents the prices from rising (and of course keeps the wages of the spinner so unnecessarily low). In all cases in proportion as the number of workmen is small, a better understanding has subsisted between the different classes; the price of labour has been uniformly better supported, and the morality of the people and general sobriety has kept pace with it.

CORNS.

Soak the feet well in warm water, mixed with bran; this should be done twice or thrice a week. The corns should be carefully cut, but not too close; then rubbed over with a piece of chalk, and bound round with a piece of lint or old linen rag. This receipt, if duly persevered in, will be found of singular efficacy.

MUSICAL WIRE.

GENTLEMEN;—It was not my intention to trouble you again upon this subject, hoping, at the same time, that Messrs. Deakin and Co.'s sense of the truth of what I had stated would prevent any more attempts to mislead the musical trade; but I find, in page 441, Vol. I of your Magazine, that a Mr. Davies has "ventured to affirm, that not one word" of what I had stated was true. Now, this is as perilous a "venture" as man ever embarked in, and makes it necessary that I should once more intrude for a few moments on your attention.

In the first place, Mr. Davies says that Mr. Deakin's wire is "a tempered steel wire." Of this I was perfectly well aware; for the manifest object which I had in view was to direct the attention of some person to the making of English iron wire to equal the Berlin.

In the next place, he says that Mr. Deakin's wire, "at a given temper, is sufficiently flexible to coil round a pin in the ordinary way." What Mr. D. may mean by "the ordinary way," I know not; but if he means *with the ordinary pin*, I must wholly deny his statement. I apprehend, however, that the sense in which Mr. D. uses the phrase *ordinary way* must refer to *the manner* of coiling, as to which there can be no difference between coiling round a needle and round a LAMP POST. If Mr. D. means with a pin of the ordinary thickness, why did he put himself to the trouble (a day or two after my communication appeared in your Magazine) of making pins two or three times larger than the ordinary ones, to try experiments with,—experiments in which, I have every reason to believe, he has wholly failed. If, moreover, this Birmingham wire is so very flexible, why does he give himself the farther trouble of annealing the ends of every piece which he uses?

With respect to what Mr. Davies says of the fastenings, I will give a rough comparative estimate of the expense of the usual and the new system, leaving your readers to judge between them:—

THE USUAL WAY.

	£.	s.	d.
Making fastenings	0	5	0
Putting strings on	0	5	0
Strings	1	10	0
Tuning	0	15	0
	£2	15	0

THE NEW WAY.

	£.	s.	d.
Making fastenings	7	0	0
Putting strings on	1	10	0
Strings (I shall state the same as the others, not knowing what Mr. D. charges)	1	10	0
Tuning	3	0	0
	£13	0	0

Here we have a difference of no less than £10 5s. created upon an article which sells for £30; so that this new way, without bettering the instrument a sixpence, increases the prime cost more than one-third. The new wire, too, is so very imperfect, that about one-half is waste. I have only to state, in conclusion, that I did not presume to address you on this subject without being well acquainted with the nature and qualities of the wire which Mr. D. extols (having seen an instrument which is strung with it). No person can feel more anxious than I do to see the use of Berlin wire superseded by equally good wire of English manufacture, but national partialities must yield to truth. I trust, the object proposed by your intelligent correspondent (p. 359, Vol. I) will be still followed up, and that ere long we may have nothing left to desire in this respect.—Yours, &c.

TRUTH, *a Member of the Mechanics' Institution.*

To the Editors of the Mechanic's Magazine.

GENTLEMEN;—Last week a friend of mine obligingly handed me your valuable and economical Magazine, containing correct remarks on the "Want of English Iron Wire for Musical Purposes," by "A Piano-Forte Maker." I have for some time particularly attended to this part of our manufactory with considerable success, and shall be much obliged by your favouring me with his address, when I will send him samples, free of expense, which I doubt not will meet with his approbation.—Your most obedient servant,

A WIRE-DRAWER.

[We are not acquainted with the address of our correspondent the "Piano-Forte Manufacturer;" but if "A Wire-Drawer" will forward the samples to our care, they shall be delivered to the "Piano-Forte Manufacturer;" on his applying for them.—*Edit.*]

WILLIAMSON'S TURNING LATHE.

3, Union-street, Lambeth, March 15, 1824.

GENT.;—Permit me to inform a Working Turner that the line I use for my lathe is a cat-gut, not thicker than $\frac{1}{16}$th of an inch; but for his information, let me say, that the pulley B, referring to the figure in No. 24, ought to be placed perpendicularly over the wheel A and pulley C, so much out of the perpendicular of the wheel A and pulley B, as to cause the line where it meets upon the pulley B to run $\frac{1}{8}$th of an inch apart, which I have no doubt will remove the difficulty and inconvenience he has experienced. As for the shape of the pulley B, I refer him to figure K, section of pulley B.

I remain yours, &c.

CHARLES WILLIAMSON,
Foreman to Mr. Pattenden.

ANSWERS TO INQUIRIES.

GAS SMOKE CONSUMERS.

March, 1824.

GENTLEMEN;—In your Magazine, page 390, Vol. I, I observe your correspondent G. W. D. has been engaged in a "very *warm*" dispute, relating to smoke from gas light, and also as to the real utility of the globular ball suspended over the gas flame.

As you have in part answered G. W. D's inquiry as to the first, I shall confine myself to the second, viz. the globular ball, or smoke-consumer, as it is called, a name it unquestionably has no claim to.

I would ask, in what way is smoke consumed? or, to speak more technically, how is combustible matter ignited?—Only by a due admixture of oxygen or atmospheric air with the combustible, in combination with caloric. Now, Mr. Editor, if the gas flame in the argand burner, is from two and a half to three inches in altitude, the whole of the combustible will be nearly decomposed, consequently there will be no carbon thrown off, provided, as you observe, the gas be perfectly pure; but if the flame be lengthened to five or six inches, a considerable volume of inflammable matter escapes undecomposed, even if the gas be ever so pure, arising from a deficiency of oxygen, or atmospheric air in combination with the gas. It is at this time the hollow ball before named is supposed by your correspondent to be effective, by consuming the smoke liberated from the gas flame, which admitting, for the sake of argument, must be by one of the following operations, viz. combustion or condensation (referring to that produced by a diminution of temperature). The first of these ignites the whole of the inflammable matter as fast as it is evolved, and consequently is denominated perfect combustion. The second process, by condensation, is effected by a rapid absorption of caloric, from the inflammable matter escaping combustion. That the former can take place within the hollow ball is impossible; for the rarefaction of the elastic fluids, created by the heat of the gas flame, together with the very small proportion of atmospheric air, prevents combustion. That the smoke can be got rid of by the second method, condensation, in so *hot a chamber* as the ball, is equally impossible, as proved by the very small deposition of carbon or lamp-black within.

The fact is, Mr. Editor, these "smoke-consumers" are of no use whatever, except to find employment for the industrious mechanic, and to please the eye of the observer. To neither of these advantages can I have the least objection; but when I find (judging from their general application) the idea of their practical utility daily gaining ground, I am compelled to offer these remarks in answer to the inquiry of your correspondent G. W. D., which, if you consider worthy a place in your Magazine, their insertion will oblige, Sir,

COMBUSTION.

TO THE "MILLER IN THE MOUNTAINS."

Were the quantity of water flowing per minute stated, also whether it is mineral or pure, it would better enable any person to say what sized machine might best engage the whole of the stream, and what would be the force it would act with: mineral water is calculated at 10·2 lb. to the beer gallon, and pure water at only 8 pounds to the beer gallon. The whole of the force of the 300 feet might be applied on a double *water-pressure engine*, with a good fly-wheel of Woolf's construction, which would turn the millstones with the same regular and uniform motion as any water-wheel. With mineral water it would act on a piston of ten inches diameter, with a force of 10,200 pounds; with pure water, it would only act with 8,000 pounds. To form ten six-feet strokes per minute, it would require, if working double, 400 gallons per minute. Until a more accurate statement of the quantity and quality of the water flowing per minute is stated, also the elevation of the 300 feet given, no regular estimate of the expense can be offered.

St. Austle, March 4, 1824.

COLOURING THE BACKS AND COVERS OF BOOKS.

Henrietta-Street, Jan. 21, 1824.

GENTLEMEN;—Observing in your Magazine, No. 19, an article in reply to the query respecting the colouring of the backs of books, and knowing you would not willingly insert any article that would mislead, I am tempted to reply to J. R., and shall merely state, that his method on trial will be found very ineffectual in producing those brilliant colours observed in our best bindings. I shall endeavour, as shortly as possible, to explain the method now employed.

For colouring the backs and covers of books, three liquids are employed as the basis for every colour: the first a solution of copperas in water, which, according to its strength, will produce every shade of grey to the most intense black; second, a solution of kali (salt of wormwood), in water, for every shade of brown; and, thirdly, a solution of grain tin in aqua-fortis, which is essentially necessary for producing those beautiful yellows, reds, and blues, so much admired. When this last is used alone, or diluted with water, it will make the natural colour of the leather approach to white; but, if mixed with a strong decoction of French berries, it will produce *yellow*; if with a decoction of red sanders or logwood, red; if with a decoction of indigo, a fine blue. And thus any colour, by mixture, may be produced.

I ought to mention that the above may be either used as mixed with the spirits, or the leather may be washed over several times with the decoctions used hot, and then either washed or sprinkled with the spirits, according to fancy.

Though not a bookbinder by trade, still I can speak from experience of the efficacy of the above directions, which I have no doubt, in the hands of an ingenious mechanic, will be hints quite sufficient to enable him to excel in that art, of which I am a great admirer.

Your obedient servant,

G. A. S.

LETTERING AND FIGURING THE BACKS OF BOOKS.

9, Belle-Sauvage-Yard, Ludgate-Hill, March 16, 1824.

Gentlemen;—In reply to "A Subscriber," page 415, I beg leave to inform him, that the back or other part of the book is first glazed (*i. e.* white of egg is gently and evenly laid on, by means of a sponge). When dry, it is rubbed slightly over, with a very small quantity of sweet oil, which keeps the gold from adhering to any other part than that touched by the tool; the tools are then applied at a proper heat;* after this, the superfluous gold is rubbed off with a flannel, and the book, when polished, is completed. It requires great practice to use the tools well, and it is some time before the young beginner is able to letter straight, particularly on the backs of books, owing to their roundness.

W. B. Jun.

INQUIRIES

No. 6.—STONE SAWING.

Birmingham, March 2, 1824.

Gentlemen;—I have a small estate in Derbyshire, upon which there is a quarry of excellent stone for paving, and building purposes, and in which there is a stratum of shell marble; but unfortunately the whole is intersected with veins of a metallic substance, which render it difficult and expensive to saw and to polish, so that I cannot avail myself of any advantage from my stone quarry, unless I can establish some machinery to saw and polish the stones.

I shall esteem it a particular favour if any of your numerous readers will inform me, through the medium of your Magazine, where I can see a stone saw-mill at work, and where I can be furnished with the necessary machinery. I have had some of my marble sawn by hand, and I find it costs me 1*s.* per foot. All I want is a machine to enable me to saw it cheaper; and I shall feel grateful to any of your correspondents and to you, if, through this application, I should be enabled to meet with it.—Yours, &c.

W. Smithers.

* Practice only will determine the "proper heat," as different subjects require different heats; but the tools are generally used when they will just hiss when touched with a wet finger.

DISCOVERIES AND IMPROVEMENTS.

HORIZONTAL ESCAPEMENTS.

An ingenious mechanic has invented a new method of making the Polished Steel Horizontal Wheel Escapements, by which they are produced of superior workmanship, in greater number, and for half of the present cost.—[We shall be obliged to the correspondent who furnishes this for a more particular description.—Edit.]

IMPROVED COACH DOOR-LATCH.

Having observed the doors of coaches frequently fly open, to the great annoyance and danger of the inside passengers, I recommend the following improvement to the latch by which they are fastened:—Let a roller be introduced, and the spring sharply bent for this roller to fall into. When the latch is down, this contrivance would prevent any sudden jerk from discomposing it, and occasion less friction, while the latch would still turn easy.

C. T.

Kenton-street, London, Feb. 17, 1824.

METALLIC CASTINGS.

Iron and metallic castings are stated to be very much improved, by subjecting the metal, when in the moulds, to pressure. This is done by making a part of the mould of such a form as to receive a piston, which, on the metal being introduced, is made to press on it with any required force. It is stated that castings obtained in this way are not only free from the imperfections generally incurred in the usual mode, but have a peculiar soundness of surface and closeness of texture, qualities of the utmost importance in ordnance, rolling cylinders, &c.

DAMP WALLS.

The following is another method [for one plan see our last No. p 31] recommended to prevent the effect of damp walls upon paper in rooms:—Line the damp part of the wall with sheet-lead, rolled very thin, and fastened up with small copper nails. It may be immediately covered with paper. The lead is not to be thicker than that which lines tea-chests.

ARTIFICIAL SLATES.

A species of artificial slates have been used in Russia, which are said to be very valuable, as being lighter than common slates, impervious to water, incombustible, and made of any required form or size. They have been analyzed by M. Giorgi, who finds them to consist of bolar earth, chalk, or carbonate of lime, strong glue, paper pulp, and linseed oil. The earthy materials are to be pounded and sifted, and the glue dissolved in water; the paper is the common paper pulp, which, after being steeped in water, has been pressed, or it may be book-binders' or stationers' shavings boiled in water and pressed. The linseed oil is to be raw. The paper pulp is to be mixed in a mortar, with the dissolving glue, the earthly materials then added and beaten up, and the oil added during the beating, as fast as it is absorbed. The mixture is then spread with a trowel on a plank, on which a sheet of paper has been laid, and surrounded by a ledge, to determine the thickness of the layer, and is then turned out on a plank strewed with sand to dry. When dry, they are passed through a rolling-mill, then pressed, and finally finished by a coat of drying oil.

The following are some of the various proportions recommended:—

2 parts paper pulp, 1 glue, 1 chalk, 2 bole earth, 1 linseed oil: this forms a thin, hard, and very smooth sheet.

3 parts paper pulp, 4 glue, 4 white bole earth, and 4 chalk; produce an uniform sheet, as hard as iron.

1 paper pulp, 1 glue, 3 white bole earth, 1 linseed oil: a beautiful elastic sheet.

When these plates or slates were steeped in water for four months, they were found not to alter at all in weight; and when exposed to a violent heat for five minutes, they were hardly altered in form, and were converted into black and very hard plates.

The Society of Arts, &c. Adelphi, have voted their large Silver Medal to Mr. R. W. Dickinson, of Newington Butts and the Albany Brewery, Kent-Road, for an improved Fermenting Tun and Self-Cleansing Apparatus.

SAFETY MASK.

The numerous and fatal accidents arising from *foul air* in wells, &c. and the more gradually destructive effects of the noxious particles inhaled by the workmen in white-lead, cotton, needle, and various other manufactories, make it extremely desirable that some means of protection from them should be devised. Permit me to recommend the use of a *sponge mask* while at work. Sponges, we know, have been used for filtering water, and why not also for filtering air? Choose, for example, a sound sponge, sufficiently large to cover the lower part of the face, say, the nose and mouth; scoop it with a sharp knife into a concave form, care being taken not to cut it too thin; then bind it on the edge with broad tape, and attach two pieces of tape or ribbon, by means of which it may be tied on to the back of the head. A mask of this sort has, in fact, been used, and a person with it on has been known to stay in a most foul cess-pool for a considerable time, without receiving the least injury, while a crust of poisonous particles adhered to the outside of the mask, which, if inhaled, would have destroyed him perhaps instantly. The mask, after having been once used, should be carefully cleaned and washed, and when about to be put on again, a little vinegar should be squeezed through it, to correct the effect of any noxious particles that may have been lurking in its interstices. PHILANTHROPOS.

NEW PATENTS.

To Howard Fletcher, of Walsall, sadler's ironmonger; for certain improvements in Tanning Hides and other Skins. —19th January, 1824.

To Robert Lloyd, of the Strand, hatter, and James Rowbotham, Great Surrey-street, Blackfriars-road, hat manufacturer; for having invented, and brought to perfection, a Hat upon a new construction, which will be of great utility.—19th Feb. six months.

TO CORRESPONDENTS.

Our file of *communications, intended for insertion*, is beginning to embarrass us by its magnitude. We mention not this circumstance with the view of deterring any of our numerous readers from adding to the list (for one time or other we shall find *room* for all that is truly valuable), but that it may induce the more impatient of our friends to regard with *less* impatience any delays that may necessarily occur in the appearance of their communications. We can but insert them as our spare room will permit, and in the order which, in our unbiassed judgments, we think best calculated to maintain the interest and variety of our miscellany. We may now mention as among those particularly designed for an early place —Mr. Joplin's Septenary System of Generating Curves—G. on the Manufacture of Flour—Bonus Homo on the Adulteration of Flour—On Soldering, by a Learner—J. J. and J. R. on the Adjusting of Two-Wheeled Carriages—Messrs. Parkes' and Son's Plan for Consuming Smoke—Description of an Improved Pivot File, by Kent—Description of a New Universal Cutting Tool, invented by J. S.—Valence's New Saw —On Thawing Frozen Water-Pipes, by Mr. Jackson—Improvement on Pickering's Steam-Engine Boiler—Economical Oil-Bottle, invented by W. K.—Improved Family Oil-Gas Apparatus, by S. T.—The Century of our indefatigable Friend S. R.—Description of a Machine for Weighing the common Atmosphere, by a Mechanic—Mesurage on Measuring Round Timber—New Syphon, by P. Vanryde—Apparatus for Lettering the Backs of Books, by W. B. Jun.—Knife-Cleaner, by J. N.—Improvement on the Portable Gas Lamp, by a Compositor—Improved Carriage invented by K. W.—Improvement on Williamson's Lathe, by W. K. S., and on Heating Rooms, by J. W. R.

Answers received to Question No. 2, from F. T. (Leeds) and P.; and to No. 5, from R. W. Dickinson—S. Pickett—Samuel Nock—J. Y.—A Constant Reader and Subscriber (Tooting)—W. J. B.—Kaleb—W. W.—Amicus—Neb Dirpo—Juvenis—J. S.—G. T.———H—S. S. Franço—Q. in the Corner.

The Substance of the Papers received on the Cube Root, if possible, in our next.

The Information desired by "Spatific" is very necessary, and as soon as we procure all the particulars, shall be laid before our readers.

We are obliged to "An Original Subscriber" for his friendly offer; but we have ourselves the work he alludes to, and intend very shortly to transfer the articles which he points out. The answer to his former inquiry is, we are sorry to say, unfavourable.

St. Mungo!!! "Hech Man!" ye're out o' date.

Y. Z. will perceive, by reference to p. 406, Vol. I, that he has been anticipated.

K. L. must be more particular. We should be happy to oblige *her*—Are we right?

G. A. S.'s liberality has suggested to him the proper explanation of the delay in the appearance of his communication.

"Agricola" and "J. Y." are requested to send to our Publishers for letters addressed to them.

In answer to "Aurum" we cannot do better than quote the laws of the London Mechanics' Institution, that regulate the point in question—"Every candidate for admission must be nominated by two members"—"The form of nomination properly filled up, must be delivered to the secretary"—"The person proposed must at the same time be presented to the secretary;" and on the person nominated signing an obligation in the books of the Institution, to observe and keep all its rules and orders, and to promote its welfare to the best of his power, and paying one quarter's contribution (5s.) at the least, he becomes a member of the Institution.

Communications last received—From the Secretaries to the Aberdeen School of Arts, and the Newcastle Mechanics' Institution—A. W. D—S. W. L. (Dundee).—T. S. (Glasgow).—Glib—Ikey Pingle—M. B.—W. Stevenson—Wm. Franks—An Old Mechanic—Mufius—C. W.—A Constant Reader—Enquiring Friends—Mr. Gladwell—and Investigator.

We beg again to mention, that our notices for each week (as in the present instance) include those communications only which are received (at the latest) on the morning of the Tuesday preceding our day of publication.

Communications (post paid) to be addressed to the Editors, at the Publishers.

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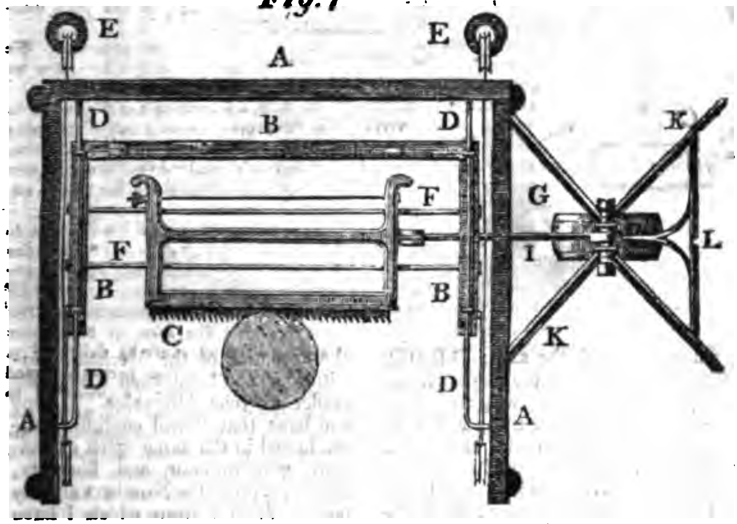
Read not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse; but to weigh and consider.—*Lord Bacon.*

No. 32.] **SATURDAY, APRIL 3, 1824.** **[Price 3d.**

Fig. 1



NEW CROSS-CUTTING SAW.

Libberton, near Carnwath, Scotland,
Feb. 6, 1824.

GENTLEMEN;—I send you herewith the plan of a Cross-cutting Saw, a contrivance of mine for cutting standing or laying trees. The common cross-cut saw requires two men at least, and sometimes a considerable number to cut large trees. But by the help of this new instrument one man will cut the largest tree with ease. The saw may be made of any length, from two feet to six or eight feet, and from one inch and a half to two or three inches in breadth. It should be nearly one-eighth of an inch thick in the face, and thin in the back. It requires little setting.

Gentlemen, as you have seen the first of this invention, I hope you will do me the justice of giving it early publicity. I am

Your most obedient servant,
A Humble Mechanic,
DIXON VALLANCE.

Description of the Drawing.

Fig. 1 is a horizontal view of the whole apparatus, arranged to cut standing timber, and of course acting horizontally; the parts are marked as in the inventor's own specification subjoined: the pendulum frame is in this figure shown to correspond with the horizontal view of the rest of the machine, looking *down* on it.

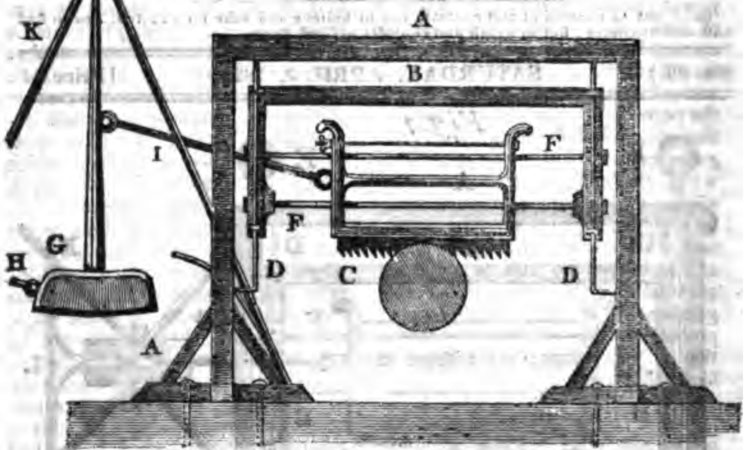
Fig. 2 is a vertical arrangement of the same apparatus, for cutting lying timber, and is an elevation, in which the pendulum frame is seen in its vertical dimensions.

The Inventor's Specification.

Fig. I. The saw slides on two steel rods, put in motion by a weighty pendulum. The rods are attached to the outer frame, which is firmly fixed to the ground with four long iron pins.

A A A, the outer frame; B B B, the

Fig. 2



inner frame; C, the saw; DDDD, the rods on which the inner frame slides; E E, the weights which keep the saw to the tree; F F F F, the rods on which the saw slides when moved by the pendulum; G, the pendulum; H, the handle; I I, the shaft between the pendulum and the saw; K K, the pendulum frame.

Fig. II. The saw is in this case adapted to the cutting of trees when lying on the ground. The frame is fixed on both sides of the tree firmly to the ground, with four long iron pins. The saw is put in motion by moving the weighty pendulum between two springs at opposite sides of the frame. In this case no weights are required to keep it into the wood, the weight of the frame being sufficient for that purpose.

The length of the pendulum may be according to the length of the saw, from six to twelve feet.

EFFECTS OF IMPROVEMENTS IN MACHINERY ON THE WORKING CLASSES.

March, 1824.

GENTLEMEN;—Having at all times appreciated very highly the value of the working classes, more especially of our artizans, and felt a strong interest in their well-being, I derived sincere satisfaction from hearing of the formation of the Mechanics institution, and have been a constant reader of your Magazine. I hope and trust that it will continue to be conducted in the same spirit of candour, good-humour, and liberality, which pervades the Numbers already published, and from which I have derived both information and pleasure.

My object in now addressing you, is to request your assistance in ascertaining the correctness of a statement which has been made by Mr. Owen, of New Lanark. That gentleman has, on various occasions, asserted, that the power of machinery in Great Britain and Ireland is now equal to the labour of two or three hundred millions of able-bodied workmen; and that forty or fifty years ago, that is to say, before the steam-engine was brought into use, our productive power did not exceed that which could be derived from the labour of twenty millions of men. Mr. Owen's statement is apparently at variance with an account which I have lately seen in some newspaper, or other periodical publication,* which

* The writer apparently alludes to a statement of Mr. Heywood, the President of the Royal Institution of Liverpool, which will be found in the Mechanic's Magazine, Vol. 1, p. [illegible].—Edit.

goes to show, that the effect of our machinery has been to give us a new power equal to that of two millions of men. If the latter estimate be correct, it is proper that Mr. Owen should not be permitted to proceed without contradiction, in exaggerating the power of our machinery, a position upon which he founds such sanguine calculations of the ease with which the whole of the community might, under certain arrangements, be supplied, beyond the utmost extent of their wants, with all the goods of life. I have no wish to agitate a question involving the merits of this gentleman's scheme, which would probably be foreign from the intention of your work; but I deem it likely that many of your readers, besides myself, would be glad to be informed of the present force of our steam and other engines, a power which, most assuredly, is only in its infancy.

One of the effects of Mechanics' Institutions, aided by your publication, must necessarily be, to increase the number of inventions for superseding human labour; and it is a point of no small importance to ascertain what are likely to be the consequences of such inventions, as respects the interests of the working classes; for if the tendency of the increase and extension of machinery should be to diminish the demand for human labour, it necessarily follows, that, so long as the supply outruns the demand, the rate of wages must be generally reduced, and the surplus hands be maintained as paupers. I am aware that the generality of writers on political economy have affirmed, that the application of a machine to a branch of manufacture, previously carried on by human agency alone, tends eventually to increase the number of hands employed in such branch of business. So long as we were nearly the exclusive possessors of stupendous machines, and the markets of the world were open to us, it is evident enough, that the cheap price at which the produce of a machine could be sold, might, by increasing the consumption of an article, afford employment for more human beings than were devoted to the production of such article, so long as its dearness limited its consumption. The subject, however, is of too much intricacy, and requires too much knowledge of details to warrant a superficial observer in coming to a speedy conclusion regarding it. One thing is quite clear, that when a machine which performs the work of 100 men, is, for the first time, introduced into a factory where 120 had been pretty constantly employed, the 100 men, whose labour is superseded, must inevitably experience much *immediate* distress. And who, in these days, can be certain that he may not be suddenly displaced, either by the introduction of a machine where none is now used, or, even where machinery is used, by a new machine of greatly superior power? If one-half of the expectations excited by Mr. Perkins and some other engineers are realized, this last case is sure to occur.

What, then, is to be done? To arrest the progress of science is now impossible. It must work its way, lead where it will. It has sometimes occurred to me, in my speculations, that the capitalist stands now in the same relation to the community at large, as the Spaniards with their fire-arms bore to the natives of Mexico and Peru, when a handful of European warriors, with musketry and artillery, brought under subjection millions of their fellow-creatures, who could not command the use of such mighty instruments. But as, in the progress of civilization, all nations have at length possessed themselves of the same description of weapons, their relative powers are now become more equal. In this point of view, it is not unreasonable to suppose that the working classes may, at some future day, when their minds are better cultivated, and they are enabled to comprehend the advantages of union, be enabled to apply a portion of their power to machinery belonging to themselves, and working for their own exclusive benefit. I cannot help thinking that a scheme of this sort would be much more rational than their present plan of contributing a part of their earnings to benefit-clubs. ARCHIMEDES.

JOURNEYMAN'S GUIDE TO FRANCE,

WITH

REASONS FOR NOT STAYING.

We earnestly recommend to the attention of our readers a small pamphlet, price 6*d.*, which has just made its appearance, entitled, "Advice to Journeymen Mechanics and others going to France." To which is added, "A Brief Account of Paris, the Price of Provisions, Rent, Clothing, *Rate of Wages* to Mechanics, &c. &c. By C. BEST." The work is the result of the author's own personal experience, and has therefore peculiar claims to the attention of his fellow-tradesmen. His *advice* is, that our mechanics should by all means stay at home; but he gives, at the same time, such directions as may enable any of them who may choose to make the experiment of crossing the channel,—either for pleasure, or with a view to settling in France,—to make the trip in the cheapest and most expeditious way, to obtain an asylum among their own countrymen when they arrive there, and to satisfy themselves completely on every point relating to rates of wages, and expence of living. The author states, we believe most truly, that most of the particulars contained in his pamphlet are "entirely new, and not to be found in any work hitherto published." We shall extract, as the specimen we like best, some of his reasons for staying at home:—

"If the mechanic leaves England under the idea that he shall obtain constant employ in France, or better wages, he will be deceived—he will not meet with either. I have known numbers of experienced good workmen unable to get work, unless they would take less wages than they could have obtained, and would have refused with disdain, in their own country, and shall hereafter prove, that when in employ, and receiving the highest wages, they fall short of the wages given in England. The very evil the mechanic, by leaving England, endeavours to avoid, he has to contend with in France—not a want of work, but too many hands to execute the business to be done. The consequence is, that having arrived in Paris with little or no money, he is compelled to work for low wages, or submit to a subscription being made by his countrymen to enable him to return to his native country, disappointed and degraded."

"My Fellow Countrymen! let me advise you to disregard any promises of great wages, three or five years constant employ, artful assurances of the cheapness of living, and other such trash—you who accept such offers, and bind yourselves by agreement, are worse off than those who go on mere speculation. You will find yourselves little better than apprentices, and in the power of unprincipled masters, with this difference, that you will have to instruct a parcel of Frenchmen (at least to work before them, which is nearly the same thing), who will very soon do the work as well as yourselves, and for one quarter of the money. These are facts which cannot be denied."

"With regard to provisions, there is little difference between London and Paris, if we look at the quality—of French bread for instance, you have more for money, but it is not so satisfying; however, as there are several kinds of bread, you will be able to choose that which suits your best. If you wish to have bread, and many other articles, equal to what you have in London, you must pay at least as much for them. The following list will give a pretty general idea, as it does not comprise the best articles:

	Sous.		*d.*
BREAD (4 lb. loaf)	12	..	6
BUTTER (Salt), per lb.	16	..	8
——— (Fresh), ditto	22	..	11
BEEF, per lb. from 12 to	16	..	8
MUTTON, ditto from 10 to	16	..	8
VEAL, ditto, from 14 to........	18	..	9

	Frs.	*Sous.*		*s.*	*d.*
A GOOSE	3	0	..	2	6
A CAPON..............	3	0	..	2	6
A POULET	1	0	..	0	10
TEA, per lb.	6	0	..	5	0
SUGAR, ditto, Lump ..	1	0	..	0	10
———, ditto, Moist ..	0	14	..	0	7

"Vegetables are much the same as in London, but fruit is prodigiously cheap.

"Good beer is only to be had at the English public houses, which will be named hereafter.—Draught, per pot, 4*d.*, in bottle 5*d.* The pots of Paris are of earthenware, and smaller than the pots of London, so that this article may be considered dearer than at the latter place; it is likewise, though pleasant, not so good.

"Brandy may be had very good at thirty sous, or 2*s.* 6*d.* the bottle; gin the same; rum is dear, but may be obtained pretty good at five francs, 4*s.* 2*d.* the bottle; wine fifteen sous, and upwards.

"Rent of course varies, as in London, according to the situation. A single man may get a lodging at three francs per week, or I should rather say a bed, for in a cheap lodging-house they generally have two or three beds in a room; if not, he must pay five francs per week at least. A man with a family would find it difficult to get a furnished room under seven francs per week, and then have to purchase almost every thing for his use, there seldom being more than a bed, two or three chairs, and a table, in what the French people call furnished apartments.

"*Clothing* is reasonable in Paris, as the following will prove:—

	Francs.		£.	s.	d.
A HAT……………………	20	..	0	16	8
A COAT ……………………	45	..	1	17	6
A WAISTCOAT …………	20	..	0	16	8
SILK DITTO……………	16	..	0	13	4
TROUSERS ……………	25	..	1	0	10
WELLINGTON BOOTS, p. p.	16	..	0	13	4
SHOES, per pair …………	8	..	0	6	8

"Ladies' wearing apparel, now that silks may be purchased in England as cheap, if not cheaper, than in Paris, may be considered dear. Cottons run high. A common cotton pocket-handkerchief, which in England might be purchased for sixpence, and of a better quality, would cost fifteen or twenty pence. Leghorn bonnets are much worn by the English ladies: they may be had as low as ten francs, and as high as one hundred francs.

"*Wages.*—The price of labour, in many cases, depends upon the agreement made between the employer and the employed; I shall, however, present my reader with a list of those trades which employ English journeymen; if, therefore, his trade is not in the list, he may take it for granted he would not meet with employ.

	Francs.		£.	s.	d.
"Baker or Pastrycook, with board and lodging ………	5	or	0	4	2
Bookbinder, from 18 to……	27	..	1	2	6
Brewer, with board and lodging……………………	10	..	0	8	4
Carpenter …………………	30	..	1	5	0
Coach-maker,* ……………					
Farrier ……………………	25	..	1	0	10
Millwright …………………	40	..	1	13	4
Printer - Compositor, if on the Establishment ………	27	..	1	2	6
——— Pressman, ditto ditto	30	..	1	5	0
Piano-forte Maker, from 30 to	42	..	1	15	0
Working Jeweller …………	21	..	0	17	6
Wheelwright ………………	30	..	1	5	0

"There are a few other trades, such as the Watchmaker, Engraver, Tailor, &c. carried on by little masters, but they do very indifferently, owing to the very low wages given to French journeymen, enabling their masters to undersell the English tradesmen."

"In stating the prices of provisions, rent, and clothing, I have studied the comfort of the traveller, as, for instance, a lodging may be had for a franc, 10*d.* per week; a complete suit of clothes for twenty francs, 16*s.* 8*d.*; and a single man may exist upon ten sous, 5*d.* per day; at least he may provision himself (in the French way) for that sum; but I am addressing myself to Englishmen, and I think I may say, without fear of contradiction, that such a mode of living as that alluded to, would not suit them, although it may the gay inhabitants of the empire of the lilies!"

"With regard to the rate of journeymen's wages, I can assure the reader I have overrated rather than underrated them, and a better proof cannot be given that they are low than this, that during ten months *I never knew an instance of a mechanic remaining* (who came to Paris on speculation) *if he possessed the means of returning to England.*"

"In short, France, for those who can afford to go on pleasure, is well worth a visit; but it is a mistaken notion to suppose we can live cheaper there than in England, if we live in the same way; besides, a man who has been accustomed to enjoy that freedom which an Englishman enjoys in his own country, should pause and consider seriously of what he is going to do, before he quits his native land.

"Then, reader, as we cannot in reality better our condition by going to France, let us endeavour to rest contented at home. Let us not desert poor old England because she has weakened her resources by a long and arduous struggle to rescue a fickle and ungrateful nation from tyranny and oppression; for, although poor, she is still richer than her neighbours, still envied by them, and long may she remain so.

"ENGLAND! WITH ALL THY FAULTS, I LOVE THEE STILL."

* In the Coach line the journeymen have what is termed the London Prices, reckoning a Franc equal to a Shilling.

INVARIABLE RATHER THAN PERPETUAL MOTION TO BE SOUGHT AFTER.

Gentlemen;—Notwithstanding the many ingenious papers which have appeared in your Magazine, tending to elucidate the subject of Perpetual Motion, with the laudable view of restraining deluded genius from the pursuit of an object which can *never be attained*, it seems pretty clear (from the observations of F. J.) that they have all proved insufficient to effect this purpose. It is not enough for one enamoured with his imagined discoveries, and more or less hallucinated by a long and almost incessant contemplation of them, to be shown the unsuccessful attempts of others; nor is it sufficient that a skilful mathematician can comprehend the demonstration of its impossibility; but I hope many may be restrained, by convincing them that it would be *utterly useless* if discovered, and that the pursuit of it is disreputable in the eyes of scientific men.

When, however, I assert that perpetual motion can *never be obtained*, I wish to be understood, that it cannot be produced by any means *strictly mechanical*, or *hydrostatical*: that it may be practicable by other means, must be sufficiently obvious to every theorist. For example: let a tube be made in the form of those used in common wheel barometers, sufficiently capacious to contain several hundred pounds of mercury; then suspend a weight on the surface of the mercury, with a proportional counterpoise, so placed, that every ascent, as well as descent, shall renovate the maintaining power of a train of wheels, terminated by a delicately small balance. By this means a very small alteration in the pressure of the atmosphere will wind up the weight or spring sufficiently to maintain the vibrations of the balance for a period of two, three, or more weeks, according to the weight of the column of mercury suspended in the tube. If it be objected, that there is a possibility of the atmosphere preserving an uniform pressure for so long a period, a *thermometer* constructed pyrometrically (*i. e.* with bars of metal possessing an equal expansibility) may be substituted; and as the power of this may, like the last, be accumulated to any given extent, it may be made to require only the constant changes of season to impart to the machine sufficient power to render it *totally independent* of the minor and inconstant variations of temperature, from which it would nevertheless frequently derive a renewal of power.

But to produce perpetual motion by mechanical means, is a proposition which in itself implies a contradiction: mechanical motion consists in an approximation to mechanical equilibrium, and it is therefore a contradiction to say that a body, or system of bodies, can constantly approach without ultimately arriving at that point of equilibrium where motion ceases.* If, again, it be said, that motion may be produced without approaching the point of equilibrium, an equally obvious contradiction is involved; for the proposition comes to this, that we may produce, by the expenditure of a given quantity of power, a renovating power, greater than that expended, which is impossible. It may not perhaps be so distinctly evident; but it is no less capable of demonstration, that projected bodies of any description, deriving their force from their momentum, are subject to the same, or (in their result) similar laws, and equally inadequate to produce perpetual motion.

Let me exhort those of your readers, who will not be convinced of the impracticability of their schemes, and who, after all that has been said, still imagine that they can accomplish that which has baffled the learned of all ages; who esteem those *facts* which science has *established*, and which have been demonstrated to our understanding, and proved to our senses, to be merely as "customs,"* or fashions, which they can lay aside when they impede their operations; these I would advise to relinquish a pursuit which is profitable neither to society nor to themselves, and direct their exertions to the investigation of subjects in which their success would entitle them to remuneration for the trouble and anxiety inseparable from speculative experiments. Instead of studying perpetual motion, which has hitherto produced nothing but perpetual nonsense, let their object be an *invariable motion*. The necessity of winding up such machines at certain periods, is a circumstance altogether unimportant and frivolous, while it remains to obviate the evils arising from external motion; to neutralize the effects of heat and cold, without the introduction of other evils; to prevent the variable and injurious influence of oil, &c. &c. Aware of the value of your columns, I shall encroach no further at present; but should the observations of any of your correspondents require it, I shall willingly resume the subject.

I remain, Gentlemen,

Your obedient Servant,

R. B.

P. S.—Since writing the foregoing, a paper has appeared in your Magazine (p. 22, Vol. II,) on the same subject. I should not be induced to animadvert on the writings of any of your correspondents in a manner calculated to dishearten them, were it not for the more important object of preventing

* Mathematically, perpetual approximation may easily be conceived: not so here, because the motion of a specific body requires a specific power to maintain it; and when the power becomes less than that quantity, motion ceases.

* See p. 15, Vol. II.

a numerous class of your readers from being misled by the mistaken notions of some who are *laudably endeavouring* to diffuse information and instruction. With this view, I shall take the liberty of pointing out some errors into which I think Mr. Deacon has fallen. First, he tells us, that the centre of gravity of every body is, "as it were, *condensed* or *concentrated*, and that it will *therefore* always have a tendency downwards, or towards the earth." Mr. D. seems to labour under a mistake here; a body may be made to have a tendency in any direction whatever by magnetism; and by *various* other means may have a tendency *upwards*, or *from the earth*. Further on is this expression: "When the motion of a body commences, its centre of gravity must either begin to ascend or descend, or move horizontally." Now this is quite erroneous; the centre of gravity may coincide with the centre of motion, and consequently remain stationary.

If Mr. Deacon reflects on what he has said on the subject of impinging bodies, I have no doubt but he will discover that he has misconceived the principle upon which their re-action depends. If a non-elastic body fall perpendicularly on a fixed horizontal plane, it will remain on that surface, and no re-action will take place, however great its momentum may be at the time of impact: the force impressed on a body so falling, is to its incident force as its elasticity is to perfect elasticity, minus the influence of external circumstances. He is also mistaken with regard to pendulum bodies: there is no horizontal motion in a pendulum, nor is its motion prolonged by the original impulse, but derives a fresh impulse, from gravity at each vibration: the perpendicular descent communicates a force which causes it to ascend to an equal height, minus the friction of suspension, and the resistance of the medium in which it vibrates. It is therefore improper to bring this forward, in order to demonstrate the properties of a body moving *horizontally*, by a force, in the production of which gravity takes no part. We ought not to reject the ideas of any one because they are prolixly or obscurely expressed, if, at least, they are accurate in themselves; but as Mr. D. has expressed his intention of favouring us with another communication on this subject, allow me to suggest to him the necessity of expressing demonstrations of this kind as clearly and as *concisely* as possible, if they are intended to be intelligible to the majority of those who read your work as a source of instruction. It is in a great degree owing to the *elaborate confusion* of too many who write on these subjects, that their simple and beautifully demonstrable principles are completely veiled from the eyes of those who, though they may not possess the advantage of the refinements of science, are no less capable of intellectual exertion, and of contemplating objects divested of their association with terms and language— a capability well described as "a faculty which few possess, and which constitutes genius."

R. B.

ON MEASURING ROUND TIMBER.

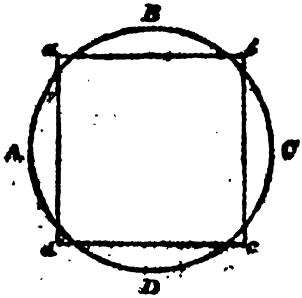
B*****, March 8, 1824.

GENTLEMEN;—In the perusal of the Mechanic's Magazine, I was a little surprised to see the paper by the "Practical Mechanic" on the Squaring of the Circle, where he flatters himself he has accomplished what has vainly occupied the attention of the first-rate mathematicians for centuries past. Mr. Bevan's letter must by this time have removed the scales from his eyes. Nevertheless, in consideration of the numerous class of measurers who adopt that part of the "Practical Mechanic's" notion (in measuring what is called round timber), which directs them "to take a quarter of the circumference or girth for the side of the square," I send you the following demonstration, which, if you will have the goodness to insert in your valuable Magazine, will show mechanics how far this method is from being true.

In measuring timber it is an erroneous custom to take a quarter of the circumference for the side of the square, equal in area to the circle. As an example of the fallacy of this method, let us suppose a tree to be 40 feet long, and 48 inches in circumference, which, by taking a quarter of the 48 inches, leaves 12 for the side of the square, and the contents of the tree is 40 feet. The ratio of the diameter of a circle to the circumference is very near as 7 to 22, and for most practical purposes is sufficiently near the truth; but for more "refined speculations," the ratio of 1 to 3·1415926, &c. (Machin and others have carried this ideal system to more than a hundred places of decimals) must be used.

Now, the circumference of the tree is 48 inches, and by inverting the above proportions, we shall have as 22 : 7 :: 48 : 15·27 for the diameter. It is shown by writers on geometry, that if you multiply half the circumference of a circle by half its diameter, you will have the area of that circle, *i. e.* $\frac{48}{2} \times \frac{15\cdot27}{2} = 183\cdot3$, which, multiplied by the length, gives the contents 50 feet 11 inches, which is 10 feet 11 inches more than by the common rule!

But as many pretended timber-measurers will not believe unless they have ocular demonstration, the following diagram cannot fail of convincing them—



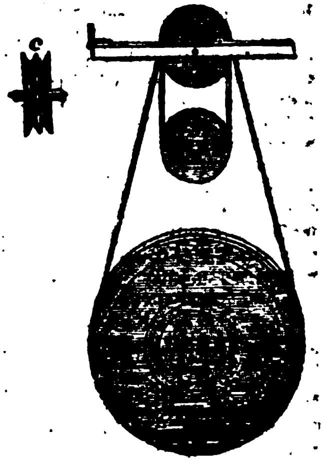
Describe a circle, as A B C D, a little more than 15¼ inches in diameter, which will be 48 inches in circumference; and on this circle describe a square, a b d e, each side of which must be 12 inches, and consequently the dia-meter will be 48, the same as the circle. Now, although the square projects over the circle at the corners, yet the circle projects beyond the square much more at the sides, which is very visible, and particularly when it is drawn on a large scale.—I am, Gentlemen,

Your obedient Servant,

Mesurage.

IMPROVEMENT ON WILLIAMSON'S TURNING LATHE.

Gentlemen;—Immediately on reading Charles Williamson's description, in No. 24 of your Magazine, of an improvement on the Turning Lathe, I put the plan into execution, but found the line break, owing to the constant friction arising from its crossing on the pulley B. The following arrangement prevented this evil: I made the upper pulley with two grooves instead of one, and the line continuous—thus:



I am aware that by this method the line has not so much hold on the pulley *b*; but for light work it is much better than C. W.'s plan. In the case of *heavy* work, the lines may be so placed as to have a *double* hold on the *wheel* as well as pulley *b*, namely, by *b* and *c* having each two grooves.

W. K. S——w.

SIR HUMPHRY DAVY'S REMEDY FOR THE DECAY OF COPPER BOTTOMS NOT ORIGINAL.

Skinner-street, March 29, 1824.

GENTLEMEN;—The following extract from an advertisement, inserted in a newspaper, entitled "*The World*," dated April 16, 1801, will, I trust, be thought worthy of a place in your valuable Magazine. While it confirms the efficacy of Sir Humphry Davy's plan for preventing the corrosion of the copper sheathing of vessels, it shows, at the same time, that he had been anticipated in that discovery. The advertisement begins as follows—"By the king's patent, *tinned copper* sheets and pipes, manufactured and sold by Charles Wyatt, Birmingham, and at 19, Abchurch-lane, London;" and after enumerating the many advantages which they possess, it goes on to say—"they are particularly recommended *for sheathing of ships*, as possessing all the good properties of copper, with others obviously superior, which the following extract, from a report founded on actual experiment, by Dr. Higgins, clearly demonstrates, viz., that this coating of tin powerfully resists the action of salt-water, and by preventing the corrosion of the copper, operates as a preservative of the iron placed contiguous to it." The dimensions and weight per foot are then mentioned, and the various purposes to which the invention is applicable.

I am, Gentlemen, yours, &c.

SAMUEL DEACON.

SIMPLE ARITHMETICAL RULES.

GENTLEMEN;—It may be useful to many to know that the result of multiplying a number by 9 is the same as that of multiplying the number by 10, and then subtracting the number from it, which may be easily performed by the eye. Thus, to find 9 times 72—

$$
\begin{array}{rl}
72 \times 10 = & 720 \\
\text{less } 72 \times 1 = & 72 \\
\hline
72 \times 9 = & 648
\end{array}
$$

In the same manner the multiplication by 11 is performed by simple addition. Thus, 11 times 72 is the same as

$$
\begin{array}{rl}
72 \times 10 = & 720 \\
\text{added to } 72 \times 1 = & 72 \\
\hline
72 \times 11 = & 792
\end{array}
$$

In different arts and trades there are many similar processes,* with numbers in use with each, which would occasionally afford matter for reflection to men of science and art, and might be usefully inserted in your Magazine.

I remain, Gentlemen,

Your very obedient

DIGAMMA.

PRIMITIVE COLOURS.

GENTLEMEN;—I am a painter by trade, and in the practice of my business I have frequent occasion to mix various shades and tints, and have often amused myself by compounding, from what I have ever considered *primitive* colours, every variety of colour I could imagine. I know little or nothing of Newton's philosophy, and perhaps it is owing to this ignorance that I am at a loss to understand how there can be seven *primitive* colours. I have been accustomed to think there are only *three primitive* colours, and that all the rest are compounded of those three. For instance, were I to paint a rain-bow, I should take *red*, *blue*, and *green*, each the brightest I could procure; and as I find the colours of the rain-bow are arranged in the order of red, orange, yellow, green, blue, indigo, and violet, I should take my red for the first, mix it with yellow for the orange, pure yellow for the third, yellow mixed with blue for the green or fourth, pure blue for the fifth, the blue with the red for the sixth or dark purple, the same colour diluted for the

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* Thus the area of a circle is found, by the mere multiplication of the square of the diameter by the decimal number ·7854, instead of multiplying the diameter by 3·1416, and that product by the ¼th part of the diameter; and the solid contents of a sphere by multiplying the cube of the diameter by ·5236.—*Edit.*

seventh or violet; thus, out of my three colours I would by mixture produce the rest, which I would call *compound* colours, and not primitive; for it would be just as reasonable to call olive, drab, or brown, primitive colours, as orange, green, indigo, and violet; for olive, drab, brown, and every shade of each of them, may be composed from red, yellow, and blue; but these last cannot be produced by any combination of other colours.

From the above considerations I do not admit of the analogy between colours and musical tones; for tones in music will not admit of that infinite combination, as to the production of *new tones*, that colours will. Nor do the combination of two or more sounds compose a new tone, but if in chords, merely a combination of certain coincident vibrations, which, being differently combined, may produce a variety of harmony, but not of new tones. BRUSH.

SILVER SOLDER.

Edinburgh, Feb. 12, 1824.

GENTLEMEN;—I take the liberty of calling your attention to the article Solder, which you must be aware is of great importance to a numerous class of workmen in metals. I have examined the Encyclopædia Britannica, and some other books on this subject, in search of a particular silver solder, but could never find it. The solder I allude to runs very easy, and is very nearly as white as silver, so that the joining can hardly be discovered. It is used in the manufacture of tea-plate ware at Sheffield, &c., but would be useful for many other purposes, were it generally known, especially to silversmiths. Having made several experiments to discover a solder of this description, I send you the most successful, as the solder obtained by it runs easy, and may be useful for some purposes, particularly when used near another soldered part. It is not, however, so near the colour of silver as that I have mentioned.—Take 1 oz. of pure silver, 1 oz. of spelter solder (such as is used by braziers), and nearly 2 dwts. of grain tin, and melt them in the order stated. The rolling must be very carefully performed, and the solder must be frequently annealed, as it is very brittle. I have made some other trials with arsenic, but have not been able to pursue them to a satisfactory result. If any of your correspondents know the component parts of the Sheffield solder alluded to, and would have the goodness to communicate it, I am sure it would oblige many, as well as

A LEARNER.

ADULTERATION OF FLOUR.

February 21, 1824.

GENTLEMEN;—Permit me to make a few observations on an article in page 59, Vol. I, "To Test the Purity of Flour." It is said, "grasp a handful briskly, and squeeze it half a minute; if genuine, it will preserve the cavity of the hand," &c. From long personal experience, I can venture to state that nothing can be more erroneous. After pure wheat has been ground in what is called *in good condition*, keep it cool, and let it dry for one month before it is dressed. If it is then kept for six months before it is used, it will, when briskly handled, be so quick, that it can scarcely be gathered, and this is genuine flour. But when wheat is ground, not in a good condition, but *in a cold state*, it sometimes becomes greased upon the mill, and the flour from it, though *not at all adulterated*, will always feel heavy in the hand, and retain any impression upon it. As to the adulterating of flour with whiting, ground stones, bones, gypsum (which I understand to be earth, plaster, or mortar), and wood-ashes, I should like to know how such adulterations can possibly take place, supposing villains could be found to make the attempt? It is well known that nothing harder or larger than grain can be admitted into the mill, and that, if a small nail or the least bit of tin falls by accident between the stones, all is confusion and disorder. I would ask further, how such pernicious ingredients could pass through the wires of the bolting machine? The number of wire in general use for flour is 60 per inch, making 3,600 holes, or [illegible] in a foot. To conclude,—as I have a boy that will soon be ready for apprenticing, and is likely to be a true chip from the old block, *willing to see all he can*, if any of your correspondents, or any of the members of the Mechanics' Institution can inform me where any of the above adulterations take place, it would enable me to show the lad something which I have never seen myself during the thirty years I have been a miller.

R. BONUS-HOMO.

P. S.—In No. IV you gave a very pleasing account of the mill-stone quarries of Nieder Mending. As these stones from Nieder Mending are not much used in England, since what are called French stones came into use, which make flour of a much superior quality, I should be glad if any correspondent would give a true and descriptive account how and where the French burrs are procured.

R. B.

MUSICAL DESIDERATUM.

Dr. Crotch has ingeniously referred the time of many charming pieces of music, edited by himself, to the vibrations of pendulums of different lengths. Is it not possible to substitute for the *comparatively* imperfect *human* beater of time (the "conductor") at our music meetings and concerts, a mechanical contrivance adapted either to the eye or ear, distinctly denoting not the *fractions* of bars, but the bars themselves! The utmost accuracy would be thus obtained, and the conductor's attention left open to many other points requiring his care scarcely less than "*time*."

Yours, &c. A. B.

GLADWELL'S LIFE-PRESERVER.

Vauxhall Road, March 22, 1824.

GENTLEMEN;—I have to express my gratitude for your kindness in inserting in your valuable work the account of my Skaters' Life-Preserver, and also to return my thanks to those correspondents who have so liberally given their opinions on my humble endeavours. Some of the improvements suggested, however, I had myself fully anticipated. As respects that of J. Bullen, Bath, it has been actually adopted in the model I have in my possession; not exactly indeed in the way he mentions, but in a manner which closes in with his opinion. At the back part of the machine there are two sliding bolts, one on each side, which shoot under the rim of the wheels between the spokes, and by locking them, form the machine at once into a sledge. I do not approve of dispensing with wheels altogether, because the machine may not be always on the ice; and if it has to be brought any distance, the wheels will be found advantageous. It is highly necessary, however, that the wheels should be locked when on the ice. With respect to C. Bellamy's suggestion, I have provided for that also, namely, by taking the top part of the hoop, and putting in a thumb-screw, having a plate rivetted inside the hoop to the underside of the screw. When the thumb-screw is turned, the plate presses on the top of the pole, and secures it at any distance. I found, however, on trying the pole, that there was no occasion for this check, as the pole was not inclined to slide so easy. To Mr. C. H. I beg leave to submit, that if the ice broke by the weight of the machine, the size of the platform would be sufficient to float the weight of itself, and two men on the top of it. His plan of a tripod is, however, excellent, both for uniformity and neatness.

G. GLADWELL.

NEW POST-BAG CONVEYANCE.

GENTLEMEN;—After a long and wearisome journey in a mail-coach (during which I had employed myself in considering the different methods that have been from time to time proposed for the conveyance of the post-bags from one part of the kingdom to the other), I fell asleep. It was not surprising, from my previous train of thought, that I should dream as follows:— Methought I was in the capital of Utopia, a country where they have no horses. I supposed, therefore, that the conveyance of their letters must be very tedious and inferior to that of the inhabitants of the earth; and when I explained my ideas to their postmaster-general, he laughed, and desired me to follow him. He conducted me to the top of the building, which was very lofty; there I saw an immense reservoir of water, from which proceeded large pipes of about nine inches diameter, to all parts of the kingdom. Having deposited the letters which were destined to the city of * * * * * in a leather bag, like a foot-ball, and tied it water tight, he placed it at the mouth of a certain pipe, into which it was instantly drawn, and then carried forward by the current at the rate of ten miles an hour. A similar method was pursued with other principal cities and towns; and as there was a regular time appointed for sending off the different balls, the persons at each station knew when to expect them. With respect to the smaller towns through which these pipes passed, there was a contrivance for withdrawing the bags without impeding the course of the fluid. A tail or lever was projected into the pipe about 1,500 yards from each post-office, balls striking against which, in their passage, caused a bell to ring, which gave notice of their approach, and at the same time awoke such dreamers as your obedient servant, W. K. S.

NEW ELECTRICAL PHENOMENON.

The electrical effect of stroking a cat briskly with one hand is well known. Shocks may also be imparted to the other hand at the same time, by forming the electric circle as follows:—Let the cat be placed before a good fire some ten or fifteen minutes, and then taken upon the lap of the operator; by passing the palm of either hand over the back, the usual spark will be emitted, and by applying the other hand to the throat, so as that the finger and thumb touch the jaw or shoulder, the hand so applied will feel slight shocks, as if discharged by the *Leyden phial*.

E. K. W.

ANSWERS TO INQUIRIES.

TO FIX WOODEN TOPS ON BREAD SEALS.

[See Inquiry, p. 366, Vol. I.]

Wooden Tops may be fixed on Bread Seals by the common cement used for electrical purposes, or perhaps by the following strong cement usually employed for porcelain:—Mix white lead, red lead, and saccharum saturni with drying oil, *i. e.* boiled linseed oil, and make it into a stiff paste. PERTINAX.

BORING WELLS.

[Answer to Question 2.]

Leeds, March 15, 1824.

Drive a cast-iron pipe *through* the gravel, *i. e.* by means of a weight hung at the end of the spring pole, used in boring; and should the pipe meet with any loose stone to obstruct its passage, put the boring rods into the pipe, and bore until the stone is broken to pieces, or driven sideways; then drive the pipe as before. I have had the management of a great many bore-holes for water in this neighbourhood, some above 100 yards deep, and many contrivances I have used, on account of difficulties met with in different strata. I shall be happy to give your correspondent every information in my power on the subject; and, if agreeable to you, will send a list of a few holes, stating the different strata gone through, and the several springs of water met with.*—Yours, &c.

T. T.

N. B.—The shell-borer must be used at times to bring out the gravel that gets into the pipe, and the pipe must have spigot and faucet joints.

INQUIRIES.

No. 7.—THE VOLUTE.

24, Somerset-street, Portman-square, February 17, 1824.

GENTLEMEN;—The mode by which Vitruvius delineated the Volute is said to have been long lost, and at last restored by Goldman.†

In what way can it be proved that the mode used by Vitruvius, which was long lost, is the same as that used by Goldman?—I remain, Gentlemen,

Your obedient Servant,

JOSEPH JOPLING.

* We shall be glad to receive this list.—*Edit.*

† See Chambers' Dictionary.

CORAL ROCKS.

Mr. Barrow, in his voyage to Cochin China, in giving an account of the coral reefs and coral islands in the East Indies, states, that in the West Indies, and indeed all over the Atlantic, though large masses and fragments of the coraline are frequently to be met with, it is remarkable that no island or reef of this substance has yet been discovered. The coast of New Holland is girt round, on the eastern part, with reefs and islands of coral, rising like a wall from the depth of a sea in which no bottom could be found with a line of 150 fathoms. These reefs and islands are the production of the polypus, animals of the genus *coralina*, which are so small that they cannot be distinguished by the naked eye.

RESOURCES OF THE SPIDER.

The following trait in the natural history of the spider may be new to most of your readers:—As I was standing on a scaffold at the top of an unfinished house, I observed a common black spider descending one of the rafters. When he came within reach of me, I stopped his progress with a stick I held in my hand; and after making several fruitless attempts to pass down by me, he ascended again to the highest part of the rafter. After arriving there, he fixed his feet in a firm position, and erecting his body, began to emit a substance from it, which, when taking the air, ascended as fast as discharged. He continued this stream till it had attained the height of about 30 feet from the top of the house; as it ascended, it divided into thousands of the finest fibres, which, being reflected upon by the rays of the sun, presented a most brilliant sight. The spider now quitted his hold on the rafter, and ascending his web a little, which buoyed him up to that height, was wafted away by the breeze, in quest, I suppose, of a more hospitable place of abode. B.

WALKING SPINNERS.

The female peasants on the river *Loire*, in France, have a mode of spinning, which enables them to perform the operation as they walk along the streets and roads. The distaff, having a long handle, is held under the left arm; the spool terminates at one end in an iron pin, pointed and made rough, so that with the thumb and finger of the right hand, a rapid twirl is easily given it, which draws out and twists the thread, the spool hanging loose as it runs round. The thread is then wound up, and another twirl is given in the same way.—They spin hemp in this manner with facility as they watch their goats, sheep, or cows, grazing in the fields.

CIRCULATION OF AIR IN ROOMS.

To render the circulation of air sensible, let the air of a room be heated by a strong fire, while the air of a contiguous room is cold; then let the door between the two rooms be opened, in which case, the hot air of one room being lighter, will pass through the upper part of the opening of the door into the cold room, and, on the contrary, the cold air of the other room being heavier, will pass into the former through the lower part of the opening; accordingly it will be found, that by applying a lighted candle to the top, the middle, and at the lower part of the opening between the rooms, a strong current of air will appear to pass from the hot into the cold room near the top; a contrary current of air will appear to pass from the latter into the former, near the lower part, whilst in the middle there is little or no motion at all, as may be clearly perceived by the flame of the candle. It is for the same reason that when a fire is lighted in a chimney, a strong current of air is occasioned to enter the room, which may be felt by applying the hand to the key-hole, or other such small openings, if the doors and windows are shut; for the air over the fire being heated, becomes lighter, and ascends into the chimney; consequently other colder air must supply its place, which forces its way through all the small openings. Were a room with a fire in it to be perfectly closed, excepting the chimney, the air in it would soon become unwholesome for respiration, and the fire would soon be extinguished. Hence it appears, that those persons mistake who expect to keep the air of a room sweet and wholesome, especially for invalids, by carefully stopping all the small apertures that admit fresh air. When the current of air that enters into a room falls immediately upon the persons who sit in the room, then it may be offensive, especially to delicate constitutions. In that case, such openings should be closed, but at the same time another should be made in a more convenient part; for a circulation of air, particularly in rooms where a fire is kept, is not only salutary and useful, but absolutely necessary.

TO EXTRACT GREASE-SPOTS FROM CLOTHES.

Spirits of turpentine are frequently used for this purpose; but in clearing one spot by this process, we have often found, to our sorrow, another in its place, deeper and broader. Highly rectified alcohol is now recommended. The mode of using it is this: a small piece of sponge is wet with it, and rubbed upon the spot until quite effaced, and the cloth is nearly dry. In this way grease-spots can be taken out from various kinds of silk, from cloaks, from carpets, from the collars of coats, &c. If the alcohol be good, and the application judiciously made, the instances of failure will be comparatively rare. When the garment can be washed, good soap and soft water will uniformly succeed in common grease or oil spots; but if any resin or wax be present, alcohol is indispensable.

Another Method, from a Correspondent.

Take half a pound of fullers' earth, make it hot through; whilst hot, pour as much cold water upon it as will make it quite wet; set it in an oven to dry; then wet it again, and dry it as before. When dry and cool, add of rectified spirit of wine and spirit of turpentine, one ounce and a half each. Mix the whole with a spoon until quite smooth, and put it into a bottle, and cork it close. When you use it, rub it on the grease spot with your finger; let it lay on until dry, when it is to be rubbed off with flannel.

TO MAKE AMBER VARNISH.

Take one pound of powdered amber, melt it in an unglazed vessel over a charcoal fire, and pour it, whilst a fluid, upon an iron plate; powder it again when congealed, and afterwards dissolve it entirely in an unglazed vessel, adding to it first linseed oil, prepared and boiled with litharge, and secondly, spirits of turpentine. With this varnish rub your vessels of wood or metal, and when carefully dried, polish them well.

MANNER OF COLLECTING GOLD-DUST AMONG THE MANDINGOE NEGROES, IN THE INTERIOR OF AFRICA.

About the end of harvest, which commonly happens in the beginning of December, a day is proclaimed on which "gold washing" is to begin; and the women are desired to hold themselves in readiness, with a spade for digging the sand, calabashes for washing the metal, and a few quills for containing it, which are all the implements necessary. On the morning the expedition commences, a bullock is killed for the first day's entertainment, and a number of prayers and charms are made use of to ensure success, a failure on that day being considered as ominous of future disappointment.

While some of the party are engaged in washing the sands, others are busy farther up the torrent, where the rapidity of the stream has carried away the clay, sand, &c. and left nothing but pebbles. Among these, pieces of gold are sometimes found of three or five drachms weight. The most effectual mode of search is, however, to dig a pit like a draw-well, near some hill which has been discovered to contain gold, and examine the different strata as they proceed downwards, and when they come to a stratum of fine reddish sand, with small black specks, they are almost certain of finding gold in one proportion or another.

The operation of washing is simply as follows: a portion of sand or clay is put into a large calabash, and mixed with a certain quantity of water. The woman then shakes the calabash in such a manner as to mix the sand and water, and give to both a rotatory motion, at first gently, but afterwards more quickly, until a small portion of sand and water at every revolution flies over the brim of the calabash. The sand thus removed, is only the coarsest particles, mixed with a little muddy water. After this operation has continued for some time, the sand is allowed to settle, and the water poured off; a portion of coarse sand, which is by this time uppermost in the calabash, is removed by the hand, and fresh water being added, the operation is repeated, until the water comes off nearly pure. The woman now takes another calabash, and shakes the sand and water gently from the one to the other, reserving that portion of the sand which is next the bottom of the calabash, and most likely to contain gold. This small quantity is mixed with some pure water, and after being moved about in the calabash, is carefully examined. If a few particles of gold are found, the contents of the other calabash are examined in the same manner; but, in general, the woman is satisfied if she can obtain three or four grains from the contents of both calabashes. The gold-dust is kept in quills, stopped up with cotton, and the washers are proud of having a number of the quills in their hair.

The negroes use small balances for weighing the gold, which they always carry about with them, and they make no distinction between the value of gold-dust and gold wrought.

WRITING INK.

The ink in common use is composed of nut-galls, green copperas, or sulphate of iron, log-wood chips, and gum arabic, infused either in rain-water or vinegar. In this composition the colour principally depends upon the chemical union between the infusion of galls and the green copperas, or sulphate of iron; and, indeed, by way of experiment, ink may be made by this means without the addition of any other ingredient. It may, however, be observed, that all the other ingredients are vegetable substances, and consequently liable to decomposition by the action of time and air; leaving only the sulphate of iron, which, having a metallic base, remains unaltered. To prove this, we know, by experience, that the legibility of decayed writings may be restored, by washing them with an infusion or decoction of galls in wine. This demonstrates that the chemical properties of the sulphate remain unaltered. There have been instances, however, in which the very operation of the copperas has made holes in the paper wherever the pen has traced. The desideratum, then, with regard to the ink employed, appears to be, to produce a fluid of equal intensity of colour, composed of such chemical ingredients as will not change by time, exposure to the atmosphere, or the action of damp, to which the decay of many old writings may in a great degree be ascribed.

In a modern work, entitled, "The New Family Receipt Book," the following is given, which is professed to be indelible:—

"Boil one ounce of Brazil wood, with twelve ounces of water, and half an ounce of alum, till reduced to eight ounces; and then add one ounce of the black oxide of manganese, reduced by decantation to extreme fineness, and half an ounce of gum arabic. This can not be effaced by oxygenated muriatic acid."

In this ink the galls are omitted, but the dying-wood retained, and the place of the sulphate of iron or copperas is supplied by the black oxide of manganese. The alum, from its astringent quality, appears to be substituted for the galls. The gum arabic is added, as in the common ink, to keep the pulverized particles in suspension.

In this composition, from the union of the mineral substances, on which, in a great degree, the colour depends, it seems probable that it would remain unchanged by time and the operation of damp. Thus it possesses a superiority over the ink in common use, while it is free from the corrosive effect often observed to accompany the sulphate of iron.

ADVANTAGES OF WEARING SILK.

(*From a Correspondent.*)

At a time when so many shackles are about to be removed from the silk trade, and such boundless anticipations are entertained of its future advancement and prosperity, it may not be inopportune to point out a few of the recommendations which silk fabrics possess to more general adoption.

The power of electricity over the body is well known; in fact, we can never enjoy health or comfort without a proportion of it in the system. When this portion is deficient, we feel languid and heavy, and very foolishly pronounce a libel on the blood, which is quite innocent, while we never suspect the damp atmosphere of robbing us of our electricity. Yet so it is. In dry weather, whether it be warm, cold, or frosty, we feel light and spirited, because dry air is a slow conductor of electricity, and leaves us to enjoy its luxuries. In moist or rainy weather we feel oppressed and drowsy, because all moisture greedily absorbs our electricity, which is the buoyant cordial of the body. To remedy this inconvenience, we have only to discover a good non-conductor of electricity to prevent its escape from the body; and this we have in silk. Those, therefore, who are apt to become low spirited and listless in damp weather, will find silk waistcoats, drawers, and stockings the most powerful of all cordials. Flannel is also good, but not near so powerful as silk. Wash-leather is likewise a non-conductor of electricity, and may be used by those who prefer it. But silk is by far the best; and those who dislike to wear flannel next to the skin, will find equal benefit by substituting cotton shirts, drawers, and stockings, with silk ones over them; or, where more heat is required, flannel ones between the cotton and the silk, for the silk should always be outermost. We like to give reasons for our advice, and our readers may depend on the philosophy of these recommendations; we can answer for their being practically correct. Silk, indeed, should be used in every possible way by the weak—in the linings of sleeves, in the stiffners of neck-cloths, and even in the entire backs of surtouts, cloaks, mantles, and in the coverlets of beds, &c.; and where health is in question, it will in the end be found to be the most economical stuff that can be used, as it will save many an apothecary's bill. When it can be a principal means of preventing consumption, rheumatism, gout, inflammations, melancholy, madness, and even suicide itself, no expense ought to be spared.

GREAT SHIP.

(*Extract of a Letter, dated Quebec, Dec.* 29, 1823).

"Do you know I came out to Canada [uncertain] to take the command, and carry home an extraordinary ship, of a new construction and immense magnitude? She is now building by Mr. Charles Wood, of Port Glasgow. Dimensions as follows:—Length of keel 284 feet (with a flat bottom)—breadth of beam 50 feet—depth of hold 32 feet—length on the upper deck 300 feet; and will admeasure 3,600 tons, or thereabouts, with a fine clear run, fore and aft, and I have no doubt she will sail well. She is to be rigged with four masts and bowsprit, and is expected to be ready for crossing the Atlantic about the latter end of June (1824). Her name is the Columbus, in honour of the first discoverer of the New World."

NEW PATENTS.

To Henry Adcock, of Summer-hill-terrace, Birmingham, gilt toy manufacturer; for an improvement in making Waistbands, or Umbilical Ventrical Lombar and Spinal Bandages or Supporters, to be attached to coats, breeches, pantaloons, and trowsers.—19th February—six months.

To Sir William Congreve, Bart.; for an improved method of Stamping.—7th February, 1824—six months.

TO CORRESPONDENTS.

Archimedes—we thought it better to suppress the passage entirely for the present.

As soon as "An Old Caster," furnishes us with his method of casting, it will be inserted, along with his Reply to J. D. S.

To "A Cotton Spinner" we return our best thanks. We should be glad to know how to address a letter to him on the subject of the concluding part of his letter.

H. ", most "sincerely," we may continue.

C. Bellamy will find a Letter for him at our Publishers on Monday.

"Economist" will be pleased to learn, that the subject he refers to has been for some time under serious consideration; the result we hope to make known very soon. His hints are excellent, and any thing farther he has to suggest will be most acceptable.

For insertion: Investigator—On Lithography, by Mr. S. Parmenter—B. S. C.—J. G.—R. W. D.—S. W. J.

More Answers to Problem No. 6—From W. D.—M. B.—Pz. J.—W—y—W. O. B.—Harold—W. W.—J. W.—Brush—A Practical Botanist—G. A. S. and Thomas Nodih.—Need we hint that these are now enough?

Communications last received,—from G. W.—Mr. Kempthorne—Mr. Simpson—Mr. Dixon Vallence—Homo—T. H. T., Stockport—A Collier—On the Hydraulic Expergifactor (from Edinburgh)—W. H.—A. R. K.—Russel—Robert Taylor—H. B.—A Brazier—Titus C[illegible]—Poynter—Liveale—B.—and [illegible] Hegbro.

Declined T. G.

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Let the hope of new discoveries, as well as the satisfaction and pleasure of known truths, animate your daily industry.—*Watts, on the Understanding.*

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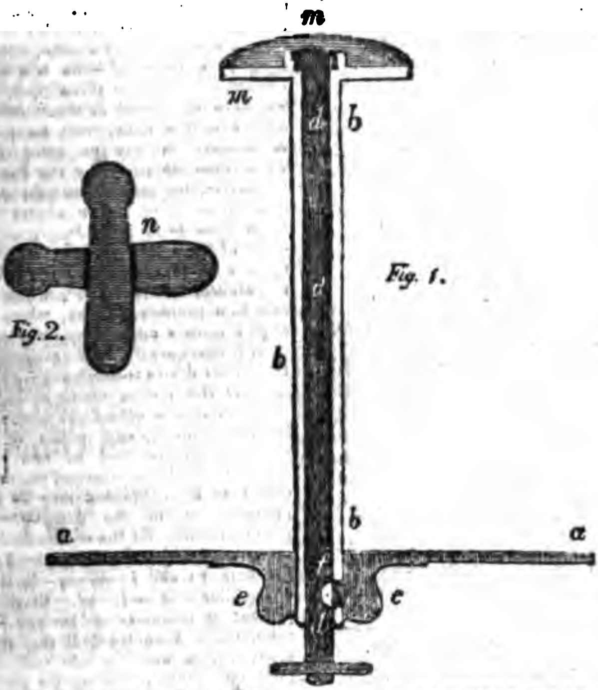


DESCRIPTION OF AN INSTRUMENT FOR SECURING DOOR AND OTHER LOCKS.*

(For the Mechanic's Magazine).

The object of the instrument about to be described, is to prevent the introduction of a skeleton key, or similar implement, into a lock, for the purpose of opening it. Its parts are as follow [See fig. 1]:

a a is a circular plate of stout iron, sufficiently large to cover the key-hole; *b b* is a cylindrical pipe, which passes perpendicularly through a hole in the centre of the plate *a a*, and is strongly fastened to it by means of the projecting shoulder *e e*; *d d* is a round bar, inclosed in the pipe *b b*; *c* is a small nut riveted to the end of *d d*, for the purpose of turning it; *m n* are two small pieces of iron attached transversely to the cylindrical pipe *b b*, and its inclosed bar *d d* respectively. When the instrument is being introduced into the key-hole, these pieces coincide, or rest longitudinally upon each other (as in fig. 1); but when passed through the

* Read (we believe) before the Cambridge Philosophical Society, but not before published.

lock, they are turned at right angles to each other, by the thumb-nut, or button already mentioned, and are, in this situation, firmly inserted cross-wise into each other, by means of a small groove, cut in each of them; *n* (fig. 2) is a front view of these pieces when secured in their place; *f* is a cylindrical aperture, part of which is in the wire *a*, and part in the shoulder *e*. To this aperture is accurately fitted the transverse bar of a strong *combination* lock (not the common lock, but one) so complex as to be totally impervious to any person who is not in possession of its key.

It is manifest, that while the bars *m m* remain across each other, the instrument cannot be removed from its place, and consequently, that so long the lock will be secure, since there is no possibility of access to the key-hole.

It is conceived that this instrument (which may be styled a lock-guard) might be advantageously employed as an additional security to strong boxes, &c. in banks, counting-houses, &c. where valuable property is deposited, and which are necessarily left from time to time unprotected by the personal presence of any one.

W. M.

April 2, 1824.

ISOMETRICAL DRAWING.

(By Professor Farish).

Abridged from the "Transactions of the Cambridge Philosophical Society."

Whoever has attended but a little to the niceties of the graphic art, must have observed with what difficulty a complicated machine is duly represented on paper. The common principles of perspective will avail but little in exhibiting on a *given scale* a complicated series of mechanical instruments, or even in forming the ground-plan of any large building. Another method has therefore been invented, which, from the principles involved, is denominated *Isometrical*.

The principles of this method are clear to every one who has a moderate knowledge of Euclid. They are fully developed in the fifteenth proposition of the fourth book of the Elements,—the inscription of a hexagon in a circle, and the converse.—If our readers will turn to the figure there given, they will perceive that the side of the hexagon is equal to the radius of the circumscribed circle; and that three radii, one of which must be vertical, drawn from the angles of the inscribed figure, and containing with each other angles of 120°, complete the figure of a cube. Now the figure of a *projected* cube is a regular hexagon. And the three lines, which we have mentioned as completing the outline of the cube, will be properly represented in any projected figure. These lines are called by the Professor, the *dexter*, the *sinister*, and the *vertical* isometrical lines. The angles which these lines form individually with the sides of the cube, are angles of 60°; and the angle contained by the dexter and sinister is that of 120°, which is the case in a projected figure, whose right angles always appear equal to one of these: consequently, by the assumption of three lines drawn through any regulating point at the angles above named, the direction of the superficial planes may be determined; and points in these planes being assumed as new '*regulating points*,' the principal parts of the object to be delineated may be accurately noted in the drawing. This plan will suffice for the representation of objects, of which right lines will form the outline; and by means of points a curved line may be traced. 'But in representing machines and models, there are not only isometrical lines, but also many wheels working into each other, to be represented. These, for the most part, lie in the isometrical planes.' In this case, the Professor applies the ellipse, which is the authographic projection of the circle. The ellipse has long been in use in such cases, though never thus applied. Referring to the cube, it will be found, that the circles which may be inscribed in the rectangular faces of that figure, become perfect and equal ellipses on the drawing. Assuming these as wheels revolving, their axes will be found to be parallel to the other sides of the cube; and their diameters are isometrical and parallel to the other sides. The minor axis, the isometrical diameter, and the major axis, are to one another as 28, 40, 49. And on this scale the plan of any object may be accurately laid down. By means of any number of these concentric ellipses and the divisions of their circumferences into eight equal parts by the two axes, and two isometrical diameters, and their subdivisions at the will of the artist, the cogs of a wheel may be correctly traced. If the circle to be represented be not *isometrical*, still the same method will obtain; because, in whatever plane it lies, the major axis of the ellipse will be the same. Such is the plan of this perspective; by which every model, or machine, and every production of art, may be represented. Buildings, bridges, arches of all kinds, and the different apartments in a college or a palace may be correctly drawn by this method. A plan of a city, with all its streets and squares, and with a picture of its churches, and even private houses, might be given; if the elevation, which this perspective supposes, will allow.

In cases where the lines are not isometrical, this art may be also applied, by drawing isometrical lines, or ellipses, as guides. An example of this is given in the delineation of an Etruscan vase, for which it is only necessary to draw a vertical line corresponding with its axis, and a few concentric ellipses, in certain points of whose circumferences the outline of the figure lies. The timbers of a ship—illustrations of animals for the study of natural history—regular fortifications—the face of a mountainous country, with all its lakes, heights, and valleys, may be depicted by this method, and on any required scale.

To the geologist also it affords a help which he has not hitherto experienced; for the strata, inclination, and position of rocks, may be likewise accurately laid down; and by the mineralogist, in the measurement of his specimens, a means of representing their angles, planes, &c. is readily acquired.

[The plan or synopsis of the annual course of Lectures on Arts and Manufactures, more particularly such as relate to chemistry, by Professor Farish, the author of this paper, (with a copy of which plan we were favoured by an anonymous friend some time ago), is by far the completest that we have ever seen. The multiplicity of practical details which it indicates,—details not to be gathered from books, nor otherwise than by long and laborious personal inquiry,—struck us at first with wonder, and left, we will confess, an impression of incredulity on our minds. But all doubt on this subject has been removed by the following observations in the *Cambridge Review*, which we have much pleasure in quoting:—

"We have often been surprised at the readiness displayed by Professor Farish in putting together those various and beautiful models which he exhibits in his annual course of lectures; and no little credit is due to him and his attendants for their ability. From a chaos of 'wheels, axles, bars, and clamps,' the Professor is enabled to call into being an infinity of most ingenious models, representing, with a precision and despatch almost wonderful, all 'the more important machines in use in the manufactures of Britain.' All instruments and engines of art and commerce, from the complex cotton-mill and steam-engine, to the lowly, but most useful, wheel-barrow, are built and set in motion within the walls and on the table of the lecture-room; and no improvement takes place in any of them without the application of it to the models. By this means, at a vast expense, and an infinity of labour, by journeyings far and nigh, and unwearied perseverance and research, Mr. Farish has been enabled to exhibit to his pupils the sources of England's wealth,—her machines and mills,—which have justly made her the glory and the boast of the commercial world."]

MR. DEACON ON PERPETUAL MOTION

(IN CONTINUATION.)

Portsmouth, March 3, 1824.

GENTLEMEN;—Before I proceed, according to promise, to apply my former remarks to the theories of those who have written in different Numbers of your Magazine on Perpetual Motion, I will previously venture to consider the subject in one more point of view.

We all know that in every mechanical operation there must be an acting power and resistance; and it has already been explained, that, in order to produce any effect, the power must be made greater than the resistance. Now, in order to construct a self-acting machine, the power, after having done its work, *as the acting power*, must, in its turn, *become the resistance*; and if we consider a wheel, lever, pendulum, or machine of any construction, we shall find, that in order to make them *go for ever*, the *power, and resistance must be constantly changing places.* I must here beg that the perpetual-motion-seeker will pay particular attention to this fact; for, unimportant as it may yet appear (if he allow it to be correct), it will lead him into a dilemma which he will not easily get out of, and it will be my object to *make him acknowledge that it is correct.* The very name of a self-acting machine implies that the machine must *act on itself.* Now, whatever a machine acts on, must be *the resistance,* and whatever acts on this resistance must *be the power; then the machine acting on itself, must be both the power and resistance.* This may, perhaps, appear like arguing on trifles. I must, however, request that the above be kept in mind, as it will be found essential in the course of the argument; and the correctness of the conclusion at which I hope to arrive, will depend entirely on the correctness of what I have assumed from the above premises, viz. *that in every self-acting machine the power and resistance must necessarily and constantly be changing places.* Thus, a weight attached to the end of a lever, fixed firmly in an axle revolving on centres, will become *an acting power,* and cause the lever to sink, until it has arrived at its lowest point, and it will then remain at rest; but, if I place another lever horizontally in the same axle, with a similar weight attached to its end, *this second weight will now become the acting power,* and it would sink in the same manner and to the same depth, but that it has to drive upwards the weight attached to the first lever; and *as the first will by its ascent oppose the descent of the second, it will now form the resistance.* In like manner, if a third lever be added, the two first weights will form the resistance the moment they get beyond the lowest point; and if I continue to insert levers in the same axle, I shall at length have a complete wheel, and every change in the situation of this wheel will alter the relative forces of the power and resistance, the weights attached to the circumference of the wheel forming the acting power, until they have arrived at a certain point, when they immediately become converted into the resistance. Having before proved it necessary, that the power *must be always greater* than the resistance in order to produce motion, and having now proved that the power *must in its turn become* the resistance, in order to continue the motion, it follows that the *resistance will sometimes be greater than the power;* and as no machine can move in such a situation, and as this situation *must obtain* in every self-acting machine, it is clear that no self-acting machine can exist. The only way of getting over this difficulty would be (as Mr. Bevan has observed) to discover some substance which is heavier at one time than another; but the weights of bodies are governed by laws so simple and clearly defined, as to prevent our supposing this possible. But, although we cannot alter the *actual weight* of a body, which will be always as the quantity of matter contained in it, yet we may alter its *relative weight* by mechanical means. Suppose, for instance, a weight to be attached to a lever in such a manner that it can be made to pass freely backwards and forwards,—if it were possible to make this moveable weight, while performing the duty of an *acting power,* take its station at the extreme end of the lever, and return, when converted into *the resistance,* to that end nearest the fulcrum, then the relative effect of the weight would be altered, and the acting power might always be made greater than the resistance, by placing it farther from the fulcrum. If, as in the former case, we complete the wheel, by joining together a sufficient number of such levers, then the weights would be *most effective* when *assisting* the motion of the wheel, and *least so* when *opposing* it. Such *a machine, therefore, would go for ever;* but, in endeavouring to take advantage of this arrangement, we should find that a greater power would be consumed in moving the weight backwards and forwards than we could possibly gain by the difference between the increasing and diminishing lengths of the levers. SUCH a machine, therefore, could not be made. Again, if, instead of applying force to move these weights, we place bullets in grooves cut from the centre to the circumference of the wheel, in the direction of its radii, then the bullets would, at a certain period, roll down, from the force of gravity, and thus being at the end of a longer lever, would *act* more forcibly; in like manner, also, would the bullets roll back again, as soon as the situation of the wheel is reversed, and thus being nearer the fulcrum, would *resist* less forcibly. *But* (a "*but*" always comes in the way) we should find, in this case, although we might get rid of the necessity of losing power (as in the former instance), in order to cause a change of situation (such change being now caused by its own weight), still we have to encounter a difficulty of equal magnitude, and one, therefore, that is insurmountable. For, in whatever direction we may cut the grooves, or in whatever situation we may place the wheel, we can never get beyond an equilibrium; and this is a familiar exemplification of one of the most beautiful of those laws of nature which govern the descent of falling bodies; for we shall invariably find, that if we make one bullet *act* on one side of the wheel at three feet from the fulcrum, it will pertinaciously retain its relative situation, when by the revolution of the wheel it shall have been converted into the resistance; and although by altering the direction of the grooves, I may produce an effect different from this, still the advantages *being as broad as they are long*, will be counterbalanced in another way; and after every trial, I shall be at last convinced, that to every bullet forming the power, I shall either have a corresponding one, at an equal distance from the fulcrum, to oppose it, or else a *greater* number of bullets at a *less* distance, or a *less* number at a greater *distance*. In short, *nature will not be turned out of her course by any human efforts;* and however far we may flatter ourselves we have proceeded towards triumphing over even one of the simplest o the laws of Nature, so jealously does she watch over them and protect them, that we must be beaten at last. Having now endeavoured to explain the cause of the failure of all those who have already attempted to produce a self-acting machine, as well as why all who may yet attempt it must fail, I have little left to do. I shall, however, in a future Number, show how these remarks can be made to apply to the various theories of your correspondents on this subject, and shall also point out their application to machines of every description; and I shall conclude by recommending a simple course to be adopted by every one who may imagine he has been the happy man to discover this long-looked-for motion.

I am, Gentlemen, yours, &c.

HENRY DEACON.

Portsmouth, April 5, 1823.

Since writing the preceding, I have seen the remarks of your correspondent R. B., p. 55, Vol. II. He says I have not been sufficiently concise and clear in communicating my views on the impossibility of perpetual motion; and there may be, perhaps, some truth in this; but from the manner in which he has endeavoured to point out some errors into which I have fallen, I am led to suppose he has misconceived my intentions. His objections, by the way, do not at all relate to the main point which I have endeavoured to establish; independently of this, they are, I think, groundless. When I speak of the centre of gravity of every body having a tendency downwards, I mean, of course, provided a body be left free to move, and is beyond the influence or action of any external force; and although a tendency upwards may be produced by magnetism, this will not in any way affect its natural tendency downwards, when the magnet is removed. That I was alluding to the *natural tendency, and not to any tendency which may be produced by artificial means* (if I may so say) may be seen from the passage in my letter, which immediately follows that quoted by R. B.; for it goes on to say, "*This natural tendency in all bodies to fall,*" &c. I have no where stated, as R. B. says, *that the centre of gravity of every body is condensed, or* [illegible] *grated.* He next quotes, "*When* *the motion of a body commences, its centre of gravity must either begin to ascend, or descend, or move horizontally,"* and he adds, "Now, this is quite erroneous! the centre of gravity may coincide with the centre of motion, and consequently remain stationary." I cannot see the force of this objection. If I have expressed more than I intended, it must be owing to the clumsy method I have of making myself intelligible. What I meant to say was merely this, that I cannot move a body without moving its centre of gravity, and the motion of such centre of gravity must be either upwards, downwards, or horizontal: the passage alluded to, goes on thus—"*for if it remain at rest, no motion can ensue.*" With regard to my remarks on action and re-action, I cannot either see any inconsistency there. I am quite aware that the re-action of bodies made to fall on and rebound from a flat surface, will be very considerably affected by the comparative elastic force of the bodies themselves; but I cannot see how this contradicts any thing I have said on the subject. I have said, "*provided there were no external impediments, the action and re-action of a body would be equal,*" and I believe this to be perfectly correct. In stating the laws of motion, or the results of any mechanical experiments, external impediments are always put out of the question, with the understanding, that in practice a considerable deduction must be made for them. Thus, in stating theoretically the power of a steam-engine, the machine is supposed to have no weight, to suffer no retardation from friction, atmospheric resistance, attraction, &c.; and all the planes are supposed to be perfect and smooth and hard; and by the same rule, why may we not, in considering the action and re-action of bodies, put these impediments out of the case? Surely there can be nothing unphilosophical in this. In those general laws which govern all bodies indiscriminately, many circumstances are, for the sake of clearness, admitted, which we shall find are not strictly true, when supplied practically to various bodies; so, although I may be justified in stating, as a general law, that action and re-action are equal, when this law is reduced to practice, I shall find that a variety of circumstances have conspired to prevent the re-action being equal to the action. An allowance must be made for external impediments, and for any circumstances that may arise from the peculiar hardness or softness, &c. of the particles which compose the bodies experimented on: a *want of elasticity* may also form one of the impediments.

With regard to pendulums, R. B. states "*there is no horizontal motion in a pendulum.*" If I had stated that a horizontal motion could be communicated to a pendulum, I think I should have had no difficulty in maintaining my ground; but I have made no such assertion: I have merely stated, "*when it is intended that perpetual motion should be produced by an horizontal movement backwards and forwards, such a body would come precisely within the laws of a pendulum;*" and whether the gravity of a bob, attached to a line, be the moving power (as in a simple pendulum), or whether an external application of force be made to move a wheel, fixed at right angles on a vertical axis, which wheel, after having performed half a revolution, is turned back again by a spring (which would be a motion similar to that of the balance-wheel of a watch); the effect thus produced, in either case, would be influenced by the same laws; and each vibration, provided there were no fresh impulse given, would become less and less, until the motion would cease altogether. The original moving power in a simple pendulum, is its own gravity *(at least if we chose to make it so)*; and in this case the greater the height from which it has to descend, the greater will be the original impulse, and the more will the *motion be prolonged*, or the longer will it last. This is what I intended to have conveyed in my former letter; and I cannot but think, even now, that it was quite as clear as this explanation. I have now merely to add, and I do it without wishing to express any thing like an angry feeling towards R. B. (for I really have no such feeling) that I shall not, in future, reply to any objections *which have not a real signature*, or, at any rate, unless I am made acquainted with the name of the writer. It cannot be an equitable warfare, where *one known individual* has to face a *world of unknown antagonists*. Any communications relating to me, *with a real name* attached to them, I shall have pleasure at all times in noticing; and I do hope to know to whom I am addressing these remarks *under the signature of R. B.*

I am, Gentlemen, yours, &c.

HENRY DEACON.

IMPROVED METRONOME.

5, Percy-street, Rathbone-place, April 6, 1824.

GENTLEMEN;—In your last Magazine (April 3, p. 59) I noticed a letter from A. B., headed "Musical Desideratum." Why he has fixed upon Dr. Crotch only as marking the time to his music, I do not understand, as many composers also give their time by Maelzel's Metronome, which denotes so many beats in a minute. It might be better if all composers would follow the same plan, as the feeling of the author would be thus more clearly expressed; but it must be confessed that there the utility of Maelzel's Metronome appears to finish.

The same idea which your correspondent A. B. has hinted at, struck me some short time since, and I in consequence have taken the pains to invent a small machine which will beat visibly at the commencement of every bar, and mark also the number of beats in each bar. It may be adapted, likewise, to any time and rate.

I shall shortly have some of these improved Metronomes finished and ready for sale, and I have no doubt that their utility will be universally acknowledged.

S. MENDHAM.

RISE AND FALL OF THE BAROMETER.

London, March 22, 1824.

MR. EDITOR;—I have perused with much satisfaction the "Observations on the Barometer," as applicable to the tropics and equatorial regions, given in the "Mechanic's Magazine" for the 2nd inst.; and also the very ingenious paper of your intelligent correspondent G., in his letter on the "Theory of Space," in No. 10, for 1st November, 1823, in which he states that he had learnt, from an indistinct newspaper notice, the circumstance of the periodical rise and fall of the Barometer, and assumes that the times of such changes are these — the greatest height at six o'clock in the evening and morning, and the greatest depression at noon and midnight.

By a reference, however, to the above "Observations on the Barometer," which are given at full length in your 30th Number, your correspondent G. will perceive that he is wrong in his supposition as to the periods of the greatest height and depression of the Barometer, as the hours of nine in the morning and evening are therein stated to be the times of the greatest height, and three in the afternoon and morning the times of the greatest depression.

I should feel obliged if your correspondent G. would favour your readers with his ideas and his reasons for having assumed, as he does, the hours alluded to, viz. six in the morning and evening, and noon and midnight, for the times of the greatest height and depression in the barometer; as probably from thence some light may be thrown on the very remarkable circumstance of the wonderful and exact regularity of these periodical changes as detailed in the observations alluded to. The subject is one open to much speculation and conjecture, as to the cause of so remarkable a phenomenon, and it is to be regretted, that the author of the "Observations on the Barometer" did not add his opinions thereon to his observations on that instrument.

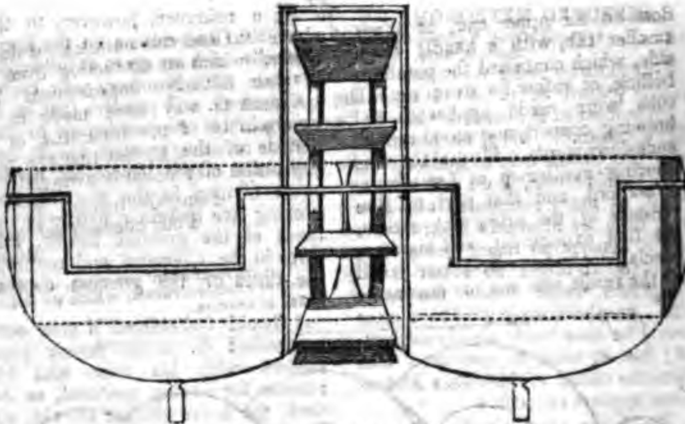
It would appear, from the observations alluded to on the Barometer, that the idea of a perpetual motion, at least between the tropics and equatorial regions, is not without some foundation; as it is evident, from a perusal of the same, that the mercury in the tube of an accurate and well-constructed Barometer *never can be at rest*: how far this idea may be carried, and to what purposes applicable, I must leave to the ingenuity of others to determine.

Yours respectfully,

INVESTIGATOR.

ERRATUM.

Page 21, Vol. II. 1st column, 13th line from the bottom—for "For at the time of a gale of wind on the western side," read, On it at the time, &c.



PADDLE-WHEEL BOAT.

Rotherhitne, Feb. 20, 1824.

GENTLEMEN;—A correspondent, in No. 25, gives us a description of a boat with a pair of paddle-wheels, to work by hand, instead of oars. I do not wish to deny him the merit of such an invention at a time when he was ignorant that any thing of the kind existed, as the thought is certainly an ingenious one; but I can assure him that I have seen a paddle-wheel boat on the Thames some time ago. I now inclose the plan of another, which I have seen several times. I do not know that it possesses any advantages above the one he mentions, but it may afford some information and amusement to your readers, which is all I wish. I believe the plan needs no reference. The machine is composed of two boats secured side to side, with a space cut out for a paddle-wheel to work in, in the middle of her; she has two keels, two sterns, and two rudders, and the water has a free passage to the paddles; she cannot upset, and draws little water (the dotted line shows the load-water-mark). I do not consider that either plan is preferable to the old one, of oars. I think the breadth would be such as to render her useless among shipping.

I remain, Gentlemen,

Yours truly,

G. B.

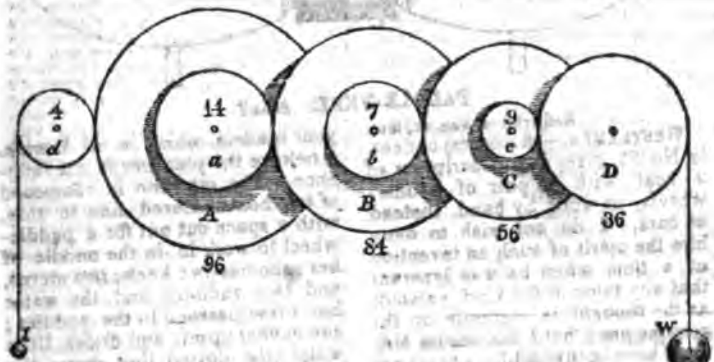
THE POTATOE-STEAMING APPARATUS.

Poplar.

GENTLEMEN;—Seeing in No. 23 of your useful Magazine a sketch of a simple method for steaming potatoes, I presume your correspondent of Lincoln, Mr. James Chambers, does not mean to assume to himself the credit of inventing the principle of this Potatoe-Steaming Apparatus; indeed I can have no reason to believe so; but lest such should be the opinion of some of your readers, I can assure them that the Potatoe-Steaming Tubs have been in use at least five and twenty years. The merit of the invention belongs either to Sir Robert Preston or Joseph Cotton, Esq.—I think the latter. I remember, at least, well that it was under Mr. Cotton's particular directions as to the mode of construction; that the first tubs were made at Mr. I. C. Steward's cooperage, between the Blackwall entrances of the West-India Docks and the City Canal. The tubs were made nearly as described by Mr. Chambers; there was first one of very large dimensions, which had a false bottom, full of holes, and a fixed lid, with a trap-door on the upper end, to admit a smaller tub, with a handle on each side, which contained the potatoes for boiling, or rather for steaming. The tubs were made applicable to a brewing copper, and stood the wide ends downwards. Most of the neighbouring gentlemen of Laytonstone, Woodford, and that part of Essex (friends of the projector) attended the first experiment, and highly appreciated the invention, particularly as the result was one ton steamed in an hour and five minutes. I do not hereby aim at detracting from the value of any improvement Mr. Chambers may have made in the portability of the apparatus, or the mode of using it, but that the meed of praise may be fairly awarded.

I am, Gentlemen,
Your obedient servant,
RUDPY.

[Our correspondent promises, in a P. S., a farther communication, which we shall be glad to receive.



MODE OF CALCULATING A TRAIN OF WHEELS.

In the above combination it is required to determine how many times *d* will revolve during one revolution of D. The numbers affixed to the wheels and pinions represent the teeth in each wheel:—

$$\frac{96}{14} \times \frac{84}{7} \times \frac{56}{9} \times \frac{36}{4} = \frac{16257024}{3528}$$
$$= 4608 \text{ revolutions;}$$

or,

$$\frac{96}{14} \times \frac{84^{2}}{7} \times \frac{56^{3}}{9} \times \frac{36^{4}}{4} = 4608 \text{ revolutions.}$$

Demonstration—If the wheel D, of 36 teeth, revolve once in a minute, and act upon the pinion *c* of 9 leaves, it will make it revolve four times in a minute; because $\frac{36}{9} = 4$, and $4 \cdot 56 = 224$, the number of teeth in the wheel C that will pass any point adjacent to the periphery of the wheel C; and $\frac{224}{7} = 32$, the number of revolutions B will make for one of D; and 32×84 (the number of teeth in the wheel B) = 2688, the number of teeth in the wheel B that will pass any part of space in the circumference of the wheel; and $\frac{2688}{14} = 192$, the number of revolutions A will make for one of D; and $192 \times 96 = 18432$, the number of teeth in the wheel that will pass any point for one turn of the wheel D; and $\frac{18432}{4} = 4608$, the number of revolutions *d* will make for one of D; and if one ounce were hung at P, it would balance 4608 ounces, or 288 pounds at W.—Q. E. D.

NICHOL DIXON.

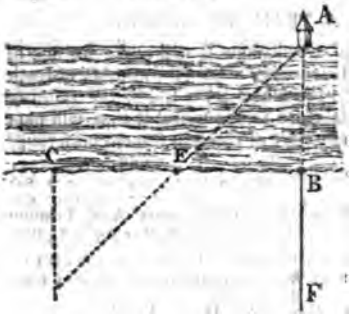
VELOCITY OF SOUND

A paper by Dr. Gregory was read at a late meeting of the Cambridge Philosophical Society, containing an account of some experiments made, in order to determine the velocity with which sound is transmitted through the atmosphere. Some of the results of these experiments are the following: That wind greatly affects sound in point of *intensity*, and that it affects it also in point of velocity; that when the direction of the wind *concurs* with that of the sound, the *sum* of their separate velocities gives the *apparent* velocity of sound; when the direction of the wind *opposes* that of the sound, the *difference* of the separate velocities must be taken; that in the case of echoes, the velocity of the *reflected* sound is the same as that of the *direct* sound, and that, therefore, distances may frequently be measured by means of echoes; finally, that an augmentation of temperature occasion an augmentation of the velocity of sound, and *vice versâ*.

PURPLE COLOUR OF GLASS INCREASED BY LIGHT.

Mr. Faraday has found, that by the exposure of plate glass, with a purple tinge, to the sun's rays during nine months, the purple tint had increased considerably, while pieces of the same glass kept in the dark had suffered no change.

TO MEASURE THE BREADTH OF A RIVER.



Let A B be the breadth of the river, and take any point, A, on the opposite side, and the point B on the other, immediately opposite to A; then, having the points A and B in one line, draw A F, and take any point E on the bank, and make E C equal E B; and taking the points E and A in one, draw A E meeting C D, drawn parallel to B F; then C D equal B A, the breadth of the river.

EXPORTATION OF MACHINERY.

(Evidence continued from p. 26, Vol. II.)

Mr. Alexander examined—

Knows generally the state of the manufactories in France for the making of machinery for the spinning and weaving of cotton. There are now between five and six hundred cotton-mills for spinning of various classes, chiefly at Rouen (called the *Manchester of France*) Lisle, St. Quentin, and Mulhouse. Generally, there are about 360 spindles to each mull, and there are some manufactories which have from 15,000, to 30,000 spindles. There are also a great many calico-printing manufactories, particularly in the departments of the "Haut Rhin," and "Seine Inferieure." The different manufactories mentioned are supplied by machine-makers established in France. In the Haut Rhin there is a very extensive manufactory set up by an Englishman named Dixon, about five years ago. He had no money when he arrived in France from Manchester, and has now about 150 men at work in his shop, very few of whom, however, are Englishmen. Besides Mr. Dixon, there is a Mr. Bouché, who makes a great quantity of machinery. There are also machine manufactories at Rouen, which supply all the cotton machines of that district. Many machines are notwithstanding imported into France, and there would be many more but for the prohibitory laws of England. A machine made in England is superior in certain metals, as cast-iron, steel and brass, and is generally better finished; but if a Frenchman has a good model of a machine, he will certainly make it as well as any English mechanic; the great difference, however, is, that the same number of English workmen will turn out sixteen machines in this country, where an equal number of French workmen will not turn out in France four of the same description. Were an order to be given in England for 50 or 60 cotton spinning machines, and an order in France for the same number, not ten could be got made in France in the time the whole 60 would be made in England. This dispatch is partly to be attributed to the superior knowledge of the workmen, but more to the great variety of tools used in the English manufactories. In the estimation of French manufacturers, a cotton spinning machine made in Manchester is about forty per cent cheaper than one made in France, that is, forty per cent in the first purchase in London; for witness supposes, that were he to buy a machine here, and send it to France *without any duty*, he should pay forty per cent less for it than if he were to purchase it of a machine maker in Paris. In other words, a machine which costs in France £100, could be purchased in England at such a price as to yield forty per cent profit were there no duty to pay in France. The duties which have to be paid in carrying machinery to Paris, amount on steam-engines to thirty per cent; on cotton-spinning and all other kinds of machinery, 15 per cent. The mode of ascertaining the value is this—a declaration is made in the entries at the (French) Custom-house of the value of the machine; with the declaration you are obliged to give a drawing of the machine, the weight of the iron, the brass, and any other sort of metals: and you say £100: upon this you pay £15; and you give a bond to the Custom-house that you shall pay an extra duty at the rate of 15 per cent, if the machine should be valued by the Committee of Arts and Manufactures beyond the declared value in the entry; then, if the committee put it at £200, you must give £15 more, and so on. The committee never go to examine the articles, except in very particular cases; they generally make their estimate by reference to similar articles. Sometimes they raise the valuation. The (general) duty of 15 per cent was laid on about ten years ago; but about six years since a great steam-engine maker applied to the French chamber to increase the duty in the case of steam-engines, or prohibit the same altogether. He was opposed by many manufacturers, who declared it was wrong to increase the duty, because France could not make a sufficient number of steam-engines to supply the country, and they would be deprived of getting engines from England, which was the chief place of their manufacture. The French legislature, however, did increase the duty from 15 per cent to 20, next to 25, and lastly to 30 per cent. Steam-engines are notwithstanding very much in demand in France. The difference in value between a steam-engine of the same power made in England and in France, is about from 30 to 35 per cent. A steam-engine of ten horses power made in England, generally costs about £700, and the same in France about £1,000. In point of quality, however, thinks they are equal. Many persons like those engines made by Mr. Edwards, an Englishman, who is the manager of M. Perrier's manufactory at Chaillot, as well as English. Mr. Edwards has put up 100, which he made in England, and since the increase of the duty he has put up 200, which he has made at Chaillot. Frequently the parts of engines, particularly boilers, are made in England, sent over to France, and then completed there. The French also manufacture rollers for calico and cotton-printing machines; they make, in short, every sort of machines in Paris which is made in England. A great number of the French machine-makers have been established many years ago, but they have improved and increased, particularly within these three or four years, during which there has been an increasing demand for machinery. Recently a great many lace machines have been introduced from England, and put up, chiefly at Calais, Douay, St. Quentin, Rouen, and Paris; in the very neighbourhood of Calais there is an immense number of Englishmen employed in that trade; these machines, though prohibited to be exported from England, are easily procured. The cost of smuggling them over is from 30 to 40 per cent. Now, however, they are made in France in considerable numbers, and witness has been told that the French work as well as the English machines; could not himself make any distinction; they both appeared to look well. In France, however, they cannot make a lace machine under £500, while at Nottingham it costs only £250 or £300. Were there no prohibition, an immense number of these machines would go to France; but is afraid the French government would soon try to raise the duty. Had the laws in England permitted machinery to go freely out, the manufacture of machines would never have reached the extent it has done in France. The French manufacturers have an idea that the English machinery is much better than the French; and if a Frenchman could get a machine that cost in France £150 from England at the same price, he would prefer the latter. Doubts not the English machines have been found better, but believes they can make as good lace with the French machines as the English. Has seen lace made in Paris, at Calais, and at Douay which he could not distinguish from English. At Calais there are 30 machines for bobbin and mechlin, which belong to twelve or fourteen masters, of whom only one is a Frenchman, the rest English; there are also many small manufactories round Calais. Witness has asked them why they established themselves in Calais, in preference to any town in the interior of France; and to several of them he remarked that the customs and government looked upon them as smugglers, because being so near the coast they could have their goods from Nottingham, and while they manufactured two pieces with one of their looms, might stamp fifty pieces (smuggled) as made by them. But they made a very fair observation—"It is not for that; it is because we are obliged to smuggle the yarn; we cannot get any yarn in France to do well for making lace; and being here near the coast, we can get yarn in the night." Has seen several of them at a stand for want of yarn. Knows that it is a very general practice for machine manufacturers in France to obtain machines from England, and sell them as their own.* The present state of the law in England has the effect of compelling the French manufacturer to have his machines made at home, and to deprive England of the manifest advantage of supplying other parts of the world, by throwing the whole trade into the hands of France. States one fact within his own knowledge. The pacha of Egypt had applied in England for cotton machinery, because he was going to grow cotton; upon which he received an answer from different machine-makers in England that he could not get that machinery in England because it was prohibited. He has therefore directed his views to France, and witness knows that the party who has written to him can supply him with a quantity of cotton machinery as good as in England, although not so cheap. Machinery has also been made in France for Switzerland, Belgium, and Germany, which would have been procured from England, had its laws permitted the export. The orders would have been sent to England, because they could have been executed there 40 per cent cheaper, *superior in quality*,† and with greater dispatch. There is no duty on the export of machinery from France; all kinds are allowed to go free.

* Which may account for some apparent inconsistencies in the preceding part of this witness's evidence; in his stating, for example, in one part, that the English machines are superior in certain metals, and better finished than the French, and yet that a Frenchman, if he has a good model, can make a machine as well as any English mechanic. It accounts also for the preference given by French manufacturers on better grounds than mere prejudice.—*Edit.*

† The witness has just said that the French makers can supply machinery "as

EMIGRATION OF ARTIZANS.

(Evidence continued from p. 26, Vol. II.)

William Turner examined—

Comes from the vicinity of Wolverhampton, and was lately engaged in fitting steam-engines at Charenton in France, under Messrs. Manby and Wilson. There are about 200 English there at work.

What induced you to go there?—I was not used well where I was at work, and I started off just for a freak to see the country.

What rate of wages do you get there?—In regular day-wages, two guineas a week.

What was the rate of wages you got in England before you went out?—About from 21*s.* to 30*s.*

Did you find any difficulty in getting employment after your arrival there?—Oh no.

Did you find any impediment in leaving the country (France)?—I was stopped for seven weeks.

Who stopped you?—The French police. I gave them my passport to sign, and they kept it all that time, on the plea that they would not sign it till I got a note from my employers.

Why did your employers not give you that note for seven weeks?—I had not finished the job I had; there was no other reason.

Did you find amongst the Englishmen there any desire to return home?—Yes, a number of them.

Why do they not return, then?—The masters have got their passports, and therefore some of them cannot, and as to others, it is rumoured about that the masters in England will not employ them if they come back, and therefore they make themselves contented there.

Do you mean to say that the masters with whom they work keep their passports, and will not let them return to England, though the men wish it?—Yes.

Were they in general satisfied with their situation?—Some of them were, some were not.

Did you save money yourself?—I did very well certainly.

What were your expenses of living at Charenton?—A labouring man lives at about 14*s.* a week for board.

What can you board in Staffordshire for?—I can board for about 12*s.*

Do you mean to say that you live cheaper in Staffordshire than in Paris?—*Yes, and better too.*

Do you believe that to be the case with the majority of workmen whom you found there?—Oh, certainly; if one can do it, another can.

Thomas Lester examined—

Is a putter of engines together; comes from Tirton, in Staffordshire, has also been employed at Charenton; received about £2 a week; 48 francs; earned at home thirty shillings.

Can you live cheapest in France or in Staffordshire?—I can live cheaper in Staffordshire than I can in France.

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good." He seems to labour throughout under some confusion of ideas on this point. We have no doubt that the English machinery is far superior; it stands to reason that it should be so. We have all the advantage of better materials and longer experience.—*Edit.*

What induced you to come back?—I did not like the country at all.

Did you find any difficulty in coming back?—None at all, for I kept my own passport in my pocket.

Do you know whether any of the other men in the factory wish to come back?—Yes, many wish to come back, if they could get back.

What do you think has generally stopped them from returning?—Mr. Manby's keeping their passports.

Will you state, taking into consideration the higher price of provisions in France, and the higher rate of wages and other circumstances connected with living, in which country, on the whole, the workmen will be most comfortable?—In England.

Even at the reduced wages you have stated?—Yes.

Is not puddling a more laborious occupation in the climate of Paris, than it is in Staffordshire?—Yes, a great deal more.

Do you consider that Paris altogether is less favourable for manufactories than Staffordshire?—Oh dear, yes.

Do the men generally complain of that?—Yes.

Are the Englishmen who are there in general sober men?—No, very much the contrary; they get drunk with the sour wine and brandy. Very few of them save money.

Do many of them get into debt?—No, they take care they will not let them get into debt.

The wine is very poor stuff?—Yes.

ON BRICKMAKING

By James Elmes, Esq. M. R. I. A., *Architect.*

The art of Bricklaying or building with Bricks is of great antiquity, and appears to be coeval with the earliest buildings on record. Josephus relates that the children of Seth erected two pillars, one of Brick and the other of stone, on which they engraved the principles of astronomy. The walls of Babylon, which are attributed by Herodotus to Semiramis, and a pyramid in Egypt, described by the same author, were built with Bricks, which were a common and durable material among all nations of antiquity. Pausanias mentions several temples and other structures built with Bricks, in various parts of Greece; and Rome we know abounds with many large and splendid edifices thus constructed.

The art of making Bricks for building has been variously practised among different nations. The Bricks of the ancients differed from ours, inasmuch as they were dried in the sun, instead of being burnt or baked by fire, and were mixed with chopped straw, to give them a tenacity of substance. Brickmaking we are informed in sacred history was one of the laborious indignities by which the Israelites were oppressed during their bondage in Egypt.

The ancient Babylonians often impressed or engraved inscriptions on their Bricks in a character which has given rise to much discussion among the learned. Specimens of them may be seen in the Archaiological department of the British Museum, in the museum of the East India Company, and in the library of Trinity college, Cambridge.

The ancient Greeks chiefly used three kinds of Bricks; the Δίδωρον, Bricks of two or three palms in length; Τετράδωρον, those of four palms; and the Πεντάδωρον, those of five palms.

The Romans, from a comparative deficiency of marble, built more with Bricks than the Greeks, and employed the arch and the vault, to which this useful material so much contributed, more than their predecessors. Their perfection in this art may be dated from the decline of the Republic, and during the splendid times of the Cæsars. The Bricks most in use among the Romans, according to the authority of Pliny, and those discovered in various parts of England, were about seventeen inches long, and eleven broad (English measure), and scarcely thicker than our paving bricks. Palladio, Sir Christopher Wren, and other eminent modern architects, have constructed beautiful and well-proportioned edifices in brick.

Bricks, as manufactured in England, are always burned or baked. Unburnt Bricks, after the ancient mode, are still in use in Egypt, and many parts of the East. The modes of making Bricks in this country are various: those manufactured in the country differ from those made in the neighbourhood of the metropolis, and are distinguished by their colour; the former being a deep red, and the latter a yellow, stone colour, and grey. The country Bricks, which are baked in a kiln, are made of a stronger earth, and have no internal firing; but the London method is beginning to be adopted near all large towns, both in England and in Ireland, where cinders and coal ashes can be procured, and by far the greatest quantity of Bricks are now made in that manner. The following is a description of the best method of making Bricks, with all the improvements that have been introduced within the last few years.

The earth most proper for making the country or kiln-burnt Bricks, which, from containing ferruginous particles, always burn red, is a stiff clay, which is tempered alone, formed in moulds, dried in the air and sun, and baked in a kiln like pottery. These sort of Bricks are hard and red, sometimes with dark grey or black ends, which, as often seen in our villages, the country bricklayers dispose in various figures of dates, chequer work, and similar forms. They are unfit for cutting and rubbing for gauged work, which is always performed with a milder sort, called *red rubbers*.

The earth selected as the most fit for making common Bricks after the London mode, is a clayey loam; and that for the superior sort, such as those which are used for facing buildings, called *malm stock* Bricks, is a lighter sort of loam, in which marl is found, frequently met with from two to three feet below the clayey loam. By the modern improvement of mixing chalk with the earth, as in the neighbourhood of London, and sea-ooze or sludge, as on the coasts of Sussex, Suffolk, and other maritime districts, a *sandy* loam can be made into good Bricks; but a strong or stiff clay, such as will do for the kiln-burnt Brick, is the most improper of any which can be chosen for this purpose.

The earth, of whatever quality it may be, should be dug in the autumn. The workmen are to be employed during the winter in preparing the earth for the ensuing season. This is done by removing the vegetable mould from the surface, which is called *uncallowing*, and placing coal ashes in proportion of two inches in thickness to every foot deep of earth, which is twelve chaldron of coal ashe, or breeze as it is called, to every hundred thousand of Bricks, and mixing them together in digging the earth; because the composition is improved in proportion as it is exposed and acted upon by the frost, rain, and wind. The mixture is then generally turned over once after it has been dug, but is seldom suffered to remain in this state of preparation longer than one winter before it is used, as it would be inconvenient to the manufacturer from the space it thus occupies; and it is considered not to improve the earth so much as it deteriorates the combustible qualities of the ashes.

When the prepared soil has thus endured a winter's preparation, it is delivered over about Lady-day to the charge of the brickmaker or *moulder*, as he is called; and the first thing to be attended to in the formation of sound Bricks is tempering the earth. This was formerly done by a gang of six persons, employed and paid by the moulder, who takes them from the heap till laid on the hack to dry by the thousand; and an active, industrious, skilful man can, with these assistants, who are often his wife and children, mould from six to seven thousand in a day, calculating from five o'clock in the morning till eight at night. One of this gang tempered and prepared the earth with a long hoe, by which he pulled it from the heap; a shovel, with which he chopped it backwards and forwards, turning it as often as he found it necessary, incorporating the ashes, sand, and earth thoroughly together; and a wooden scoop, with which he threw water over the mass in preparation, to bring it to a more ductile state. The great difficulty of having this operation, on which so much of the success of the manufacture depends, well performed, has occasioned the introduction into extensive works of machines called *pug-mills*, into which the prepared earth is wheeled after it is mixed with a proper quantity of water. Care should be taken, whether the tempering be done by men or the mill, that too much water be not used, as the more solid the Brick is delivered from the mould, the better it retains its form on the hack where it is set to dry, the less it shrinks in drying, the sooner it dries, and the better and more shapeable it burns.

When the mass is sufficiently mixed, by either of the above modes, it is laid in small parcels, well kneaded, on the moulding table, which is covered with dry sand. The moulder throws it smartly into the mould, presses it down to fill all the cavity, and strikes off the overplus with a stick. He then turns the newly formed Brick from the mould on to a thin board, larger than the brick, which is removed by a boy to a light latticed wheel-barrow, and is thus conveyed, covered slightly with fine dry sand, to the hacks to dry. The bricks are arranged on the hacks with great regularity one above the other, a little diagonally, in order to give a free passage to the air.

When the Bricks are sufficiently dried in the hack, which in fine weather may be in about nine or ten days, they are ready for the fire, which completes the operation. It is of the greatest consequence to the quality of the Bricks, that they should be thoroughly dry before they are set in the clamp, which can only be ascertained by breaking a few in halves, selected from various parts of the hack. If the operation of drying in the hack be not thoroughly performed, the Bricks will never burn sound; and the moisture which ascends from them in the form of vapour, renders the upper courses in the clamp peculiarly unsound.

The clamps are generally of an oblong form, and contain from one hundred thousand to half a million of Bricks. The cinders by which they are burned, are placed in two or three layers, between single courses of Bricks, on a foundation, formed of three courses of *place*, or half burned Bricks, from another kiln, or the driest of those about to be burned. In these lower courses, there are generally three apertures left running across and through the clamp, which contain fagots and coals, for the purpose of setting it on fire.

In about twenty days, or, if properly fueled and constructed, when the fire is all burned out, the Bricks are fit for use. Those in the interior of the clamp should be hard, square, and of a bright good colour. These are the stock Bricks of the London market.

The preparation of the loam, marl, ooze, chalk, &c. with which the beautiful yellow *malm stock* of London, and the pale Bricks of the Ipswich sort are made, requires more attention, and a longer and more careful process. The earth and other ingredients, with which the soil for *malm Bricks* are composed, are wheeled into a mill with a due proportion of water. This composition is then ground in the mill, which is supplied with two sets of knives and harrows, and runs out in a state of thick mud or sludge through wooden spouts, into hacks which are raised near the mill. It is there left, till by the water soaking away, and by absorption, it acquires a sufficient consistency or solidity to be kneaded for the moulder. The moulding, drying on the hacks, and burning in the clamps, is performed exactly as before described for common stocks, but with more care and precaution.

As marl is not always to be found where *malm stock* Bricks are required, the method used by Mr. Lee, of Lewisham, is so good a substitute, that it is worthy the attention of builders, who may wish to manufacture these beautiful Bricks without marl. After many experiments, occasioned by the paucity of marl in the London districts, Mr. Lee discovered that chalk, mixed in certain proportions with the loam, and treated in the usual manner, produced an excellent substitute. For this discovery, he took out a patent, which having now expired, this mode of mixing a small quantity of chalk with the Brick earth, is generally adopted round London, for the purpose of giving colour and soundness to the Brick. At Emsworth, in Hampshire, and at Southampton, ooze or sludge from the sea shore, which contains much saline matter, is used for a similar purpose; but however sound these Bricks are, they have neither the rich brimstone colour of the London malm *stock*, nor the regular stone-coloured creamy hue of the Ipswich Bricks.

Bricks, like most other useful articles in this country, are subject to a duty, and form an important part of the annual revenue of the government. They are also subject to a regulation as to size. By the 17th Geo. III. cap 42, all Bricks made for sale, shall, when burned, be not less than eight and a half inches long, four wide, and two and a half thick: and by 43 Geo. III. cap. 69, which consolidated the excise duties, every thousand Bricks made in Great Britain, not exceeding ten inches long, three inches thick, and five inches wide, are liable to a duty of five shillings; and exceeding these dimensions to ten shillings.

The principal Bricks used in the United Kingdom, are *stock* and *place* Bricks, from the *stock* Brick clamp; *malm stocks*, *cutters*, *seconds*, and *pavers* from the *malm* clamp, *Red stocks*, *paving Bricks*, *fire Bricks*, *foot and ten-inch tiles*, from strong clay, and burned in a kiln. Of the *fire Bricks*, the best are from Windsor, Stourbridge, Wales, and some of the iron counties. The Welch are excellent, and will stand extreme heat; they are made of large sizes for the boilers of sugar houses, brewers' coppers, &c. and are called Welch lumps. Patents have been granted, and descriptions published of Bricks of various and fantastic shapes, which not having gained general use, are not here noticed.—*Enc. Met.*

MAGNETIC INTENSITY.

Mr. G. Harvey, M. G. S, &c. has found, by Coulombe's apparatus, that a box chronometer exhibited singular proofs of strong and active magnetism. It contained a remarkable quantity of steel, and every part of it exhibited vigorous polarity. Every screw displayed its influence, and the frame alone contained ten large and several small screws; and the same intense and active magnetic power was exhibited by the chain, the axles of the wheels and pinions, the arbor of the fusee, and the balance of its springs. Mr. Cox, the agent for Arnold's chronometer at Plymouth, remarked, when he saw this chronometer, that it appeared nothing less than a *magazine of magnets*. Mr. Scoresby recommends platina, or an alloy of platina, for the balance of chronometers. Gold is said to be considered as well adapted for the balance-spring.

NEW PYROPHORUS;

OR,

INSTANTANEOUS FIRE-LIGHTER.

In determining the composition of tartrate of lead, Dr. Friedmann Gobel, of Jena, observed that this salt, when heated in a glass tube, formed a fine pyrophorus. When a portion of the deep brown mass is projected from the tube, it instantly takes fire, and brilliant globules of metallic lead appear on the surface of the substance in ignition. The effect continues much longer than in other pyrophori.

EFFECT OF MUSIC ON ANIMALS.

In the human ear the fibres of the circular tympanum radiate from its centre to its circumference, and are of equal length; but Sir E. Home has found that in the elephant, where the tympanum is oval, they are of different lengths, like the radii from the focus of an ellipse. He considers that the human ear is adapted for musical sounds by the equality of the radii; and he is of opinion that the long fibres in the tympanum of the elephant enable it to hear very minute sounds, which it is known to do. A piano-forte having been sent on purpose to Exeter Change, the higher notes hardly attracted the elephant's notice, but the low ones roused his attention. The effect of the higher notes of the piano-forte upon the great lion in Exeter Change was only to excite his attention, which was very great. He remained silent and motionless; but no sooner were the flat notes sounded, than he sprung up, attempted to break loose, lashed his tail, and seemed so furious and enraged, as to frighten the female spectators. This was attended by the deepest yells, which ceased with the music. Sir E. Home has found this inequality of the fibres in neat-cattle, the horse, the deer, the hare, and the cat.

The Proprietors of the MECHANIC'S MAGAZINE, desirous of evincing their gratitude for the extensive support which this Publication has received from the Mechanics of the British Empire, and from the Friends of Knowledge generally, and of contributing still further to promote among the Working Classes a Spirit of Observation and Improvement, offer for the Present Year the following

PRIZES FOR COMPETITION.

To be awarded by the following Gentlemen, who have undertaken to investigate the Claims of the Competitors.

Dr. BIRKBECK, President of the London Mechanic's Institution, President of the Meteorological Society, &c. &c.

Dr. OLINTHUS GREGORY, Professor of Mathematics in the Royal Military Academy, Woolwich, one of the Secretaries to the Astronomical Society, &c.

JOHN MILLINGTON, Esq., Professor of Mechanics in the Royal Institution, Vice-President of the London Mechanic's Institution, one of the Secretaries to the Astronomical Society, &c. &c.

I—VII.—To the Journeyman or Apprentice, in each of the following Classes of Tradesmen, who shall have invented or discovered the most useful improvement in the art which he practises,

An Honorary Medallion, with Ten Pounds in Money.

CARPENTERS AND JOINERS.	COACH-MAKERS & WHEEL-WRIGHTS.
MILLWRIGHTS.	WATCH-MAKERS.
ENGINEERS (generally).	WEAVERS.
SHIPWRIGHTS.	

VIII.—To the Journeyman or Apprentice Cabinet Maker who shall produce the best Specimen of Cabinet Work, entirely made by himself, *an Honorary Medallion, with Five Pounds in Money.*

For the Second best Specimen, ditto, *an Honorary Medallion, with Two Pounds in Money.*

IX.—To the Journeyman or Apprentice Turner, who shall produce the best Specimen of Turnery, in Wood, Ivory, Brass, or any other Metal, entirely his own workmanship, *an Honorary Medallion, with Five Pounds in Money.*

For the Second best ditto, *an Honorary Medallion, and Two Pounds in Money.*

X.—To the Journeyman or Apprentice Cutler who shall produce the best Specimen of Cutlery, entirely his own workmanship, *an Honorary Medallion, and Five Pounds in Money.*

For the Second best ditto, *an Honorary Medallion, and Two Pounds in Money.*

XI.—To the Writer of the best Essay, being a Journeyman or Apprentice, on the Properties of the Lever, whether straight, angular, or bent, *an Honorary Medallion, and Books to the value of Five Pounds.*

XII.—To the Writer of the best Essay, being a Journeyman or Apprentice, on the Properties of the Wheel and Axle, and their employment in Machinery, whether through the intervention of bands, or of teeth and pinions, *an Honorary Medallion, and Books to the value of Five Pounds.*

CONDITIONS.

THE COMPETITORS MUST BE BRITISH SUBJECTS.

Every Improvement for which any of the first Seven Prizes shall be claimed, must have been actually put in practice, and its successful adoption be certified by one or more masters in the trade which it concerns.

Every Competitor for these Prizes must give the fullest Description in his power of his particular Improvement, and its Advantages, accompanied with a Descriptive Drawing or Model.

All Models or Specimens produced in competition for any of the Prizes hereby offered, or such selection from them as the Judges may think proper, shall be presented to the *Museum* of the *London Mechanics' Institution*, and remain the property of that Society. Such as are not so presented, to be returned to the parties.

Competitors to transmit their Specifications, Drawings, Essays, Models, or Specimens, with their Names and Addresses (carriage and postage paid) on or before the 24th December, 1824, addressed thus—

"*To the Editors of the Mechanic's Magazine,*
"Care of Messrs. KNIGHT & LACEY,
"PRIZE CLAIM." "*Paternoster Row, London.*"

T. C. Hansard, Pater-noster-row Press.

Mechanic's Magazine,
Museum, Register, Journal, & Gazette.

"Genius is the gift of the Deity; it discovers itself without effort, and is unknown to the possessor."

No. 34.] SATURDAY, APRIL 17, 1824. [Price 3d

Fig. 1

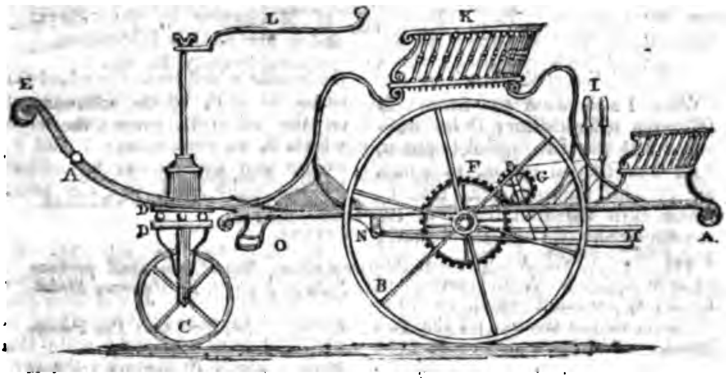
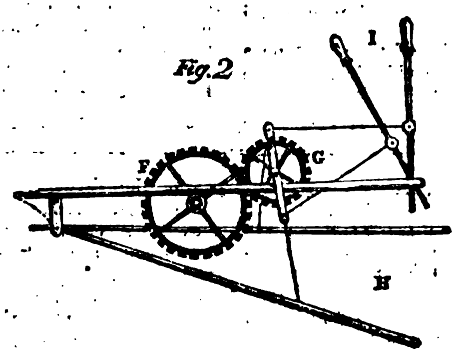


Fig. 2



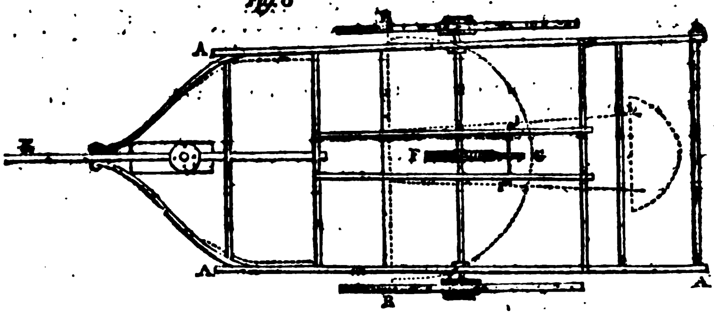
PEDOMOTIVE CARRIAGE.

Gentlemen; — Having seen in your valuable Magazine for Feb. 21st a plan of a carriage of slender construction, which may be propelled on the road without the assistance of horse, &c. by E. Jameson, I take the liberty of sending you a plan of a machine for the same purpose, invented by myself, which was exhibited in Manchester, to the entire satisfaction of a number of clever mechanics; but not having been in the habit of acting as a showman, I found my expenses greater than my receipts, and was forced to give it up for a bad job.

This machine went with ease eight miles per hour, carrying two persons besides the one who conducted it.

K. W., *a Welchman.*

Fig. 3



Description of the Carriage.

Figs. 1 and 2—A the frame; B the large wheels ditto; C the fore-wheel; D the two parallel plates, with four friction rollers, to which are attached the spindle and tiller L, which turn the iron frame of the steering-wheel C; E the scrowl; F the large wheel on the axletree, as seen in fig. 1, 2, and section of fig. 3; G the small wheel, as ditto; H the two feet treadles; I the two handles; J driver's dicky; K front chair, M the two springs; N the fulcrum of the treadles; O the step; P foot-board.

Fig. 3—Section of the wheels on a larger scale, from which it will be seen that while the left hand is extended, the left foot gives motion (by means of the treadle which turns the wheel G) to the wheel F, which being placed on the axletree, turns the large wheels B, as seen in figs. 1 and 2, as also that the left foot is assisted by the right hand, and *vice versâ* alternately.

P. S.—I beg to ask Mr. E. Jameson the following questions, which I hope Mr. J. will have the goodness to answer, viz.—How is that long lever managed? and if the acute angle it makes with the carriage-pole be its fulcrum? likewise, if the other angles have moveable centres? also the use of the standard which the lever rests in, and the two handles behind the carriage?

DRY-ROT IN TIMBER.

Chatham Dock-yard, March, 1824.

Gentlemen;—The following observations on the probable cause and prevention of the Dry-rot, may not be unworthy the notice of your intelligent readers, so as to induce them to point out what is erroneous. In order that general good may in time be produced on this interesting subject, every one should contribute his mite of information towards increasing and improving the general stock: in the multitude of council only is wisdom to be found.

The national debt owes much of its present enormous bulk to the dry-rot! Would to God it could catch the disease, so as to be mouldered away harmlessly! not, however, as ships and public buildings are made to disappear by it, at the expense of every individual in the empire. The subject being of national moment, is worthy the most rigid scientific inquiry.

The dry-rot appears to arise from the aqueous matter in timber suffering decomposition, for the following reasons: there is no dry-rot in wood kept perfectly deprived of humidity, and water does not produce it in wood which is always wet throughout; but humidity is indispensable to produce this rot; yet the wood, when rotted, has not the slightest appearance of humidity, it being pulverent and dry as possible.

Evaporation might remove the water, but would not produce dry-rot, neither would dryness. The humid state of the wood when sound, and its desiccated state when rotted, leaves it a fair inference that *the dry-rot is the natural consequence of the internal waters or juices in timber having suffered decomposition.*

Perfect dryness, and wetness even to saturation, it is well known prevent dry-rot; but the former state being impossible to be maintained in ships, the latter affords ample means for conveying the anticeptic principle to all parts where the cause of the evil exists; and if so, the succulent wood is the most capable of preservation by art, the remedy being to diffuse throughout the aqueous matter in the wood that which shall keep it in a compound state, as a fluid, or cause it in this mixed state, by being, as it were, a new substance, to become aggregated with the wood itself.

It should be noticed, likewise, that as no species of matter can act on itself, neither does any phenomenon take place without many proximate causes being concerned; and hence the aeriform medium which surrounds timber subject to the dry-rot, is one in promoting dry-rot circulation, as much as galvanic circulation, when more or less promoted by confined or unventilated air, contributes to that transfer of elementary matter from sound wood, which leaves nothing but decomposed wood behind. Pure air has no such disposition, but even in pure air, woods in contact, from their dissimilarity and internal humidity, galvanise each other. Humid wood may be considered as containing water in every physical point, the elements of which, when it is decomposed, become mixed with certain constituent elements of the wood, that assisted the decomposition; and the whole become evolved together, vitiating the air they enter, and leaving the wood throughout like a tissue deprived of its warp or weft, destroyed in strength and texture, and greatly reduced in weight.

There is nothing more silly than to imagine that fungus (which but occasionally appears), is the *cause* of dry-rot, it being but the *consequence* of some part of the juices of the wood or tree (that in its growing state would have eventually become wood), vegetating in a novel direction: many are the instances of fungi without dry-rot, and dry-rot without fungi being any way present.

The foregoing may be considered approximations to the cause and progress of wood suffering the dry-rot, which, if even bordering on the fact, will, in efficient hands, be doubtless productive of a preventive to this great national evil. The discovery of the cause should, in this enlightened age, most indubitably be attended with its concomitant cure.

Experience proves how almost imperishable timber is rendered by having been buried for a length of time in the earth: would not trees newly felled, by such a process, have their original organization so destroyed, and their juices changed, as to render them as inactive on each other as water on marble, or marble on water? Similar is the process of preserving meat; the lobes are broken by rubbing, in order that salt shall mix with their aqueous contents, and prevent decomposition, as the same is effected without salt, if the animal matter be deprived of all humidity.

Again, would not the water in which thick stuff is boiled, if saturated by unslacked lime, by its deposit on entering the wood, prevent decomposition of its internal water? All wood imbedded in mortar, is preserved by it from dry-rot. There is nothing cheaper for the purpose. Obtained pellucid, no inconvenience would arise in working the wood after being boiled, and the residual lime would still have its use. Soaking in lime-water might also be resorted to.

To conclude as I commenced, I flatter myself these speculations may be improved on for the benefit of society, and which, through the medium of your very valuable Magazine, are certain of being noticed by every inquirer after scientific information.

Your obedient servant,

T. H. Pasley.

SELF-REGULATING LAMPS.

Gentlemen;—In your Magazine for Feb. 7, 1824 (Vol. I, p. 382), it is stated, that a "Balance or Self-acting Lamp has been laid before the Society of Arts;" but the account which is given of the same in the article alluded to, is so brief and imperfect, that I, for one, am quite at a loss to comprehend either the nature of its construction or the mode of its operation. And as I do not happen to be acquainted with any member of the Society of Arts, I take the liberty to request that either you or your correspondent J. Y. (who appears to be quite master of the subject, so much so, as to pronounce the alleged invention no better than what may be called a mechanical piracy) would favour your readers with a more clear and intelligible description of the said lamp. J. Y. affirms (Vol. I, p. 406, Mech. Mag.) that the merit of the invention (whatever it may be) is due to a "very poor hard-working shoemaker," and that he (J. Y.) has "seen such a lamp in Fifeshire, Scotland, 14 years ago!" I own that I was rather surprised at this latter declaration of J. Y., because it was so much at variance with my own knowledge and observation. I was certainly not so fortunate as J. Y., for, during my abode in that portion of North Britain, I believe I never once saw or even heard of a self-acting lamp (strictly so called) of any description. It would be very gratifying to several of your readers, who are zealous experimenters on lamps, if J. Y. would condescend to mention the name of the ingenious "Shoemaker," and the place of his abode (which, by the way, would be the most effectual plan of securing to the poor man the honour of the aforesaid invention), or, at any rate, that he would favour them with a drawing and description of the shoemaker's lamp, so as intelligibly to explain its principle, as has been done in a parallel case, by "Q in a Corner," in your Number (p. 4) for March 1824.—It would indeed be the most effectual means of dispelling the obscurity which somehow rests upon this whole subject, and of promoting the interests of science and of justice (both of which to you, Gentlemen, are no doubt matters of especial and paramount consideration) if J. Y. would furnish you with *drawings and descriptions of both the said lamps*, in order that the same might be placed in your columns side by side, so that your readers might be able, on sure grounds, to form their own conclusions. Truth can never have any thing to dread from the closest investigation; but her interests are almost sure to suffer by obscure descriptions, ambiguous insinuations, and uncontradicted mis-statements. Hoping that you will honour this communication with an early insertion in your valuable pages,

I remain yours,

Philophos.

[We have received the description of a new Self-regulating Lamp, invented by Mr. W. M., which seems to us of a most ingenious and excellent construction. It will appear as soon as we have the drawing from the engraver.—*Edit.*]

SHIPS' CHRONOMETERS.

Gentlemen;—The protection, as far as practicable, of Ships' Chronometers from the influence of electricity, having been, if I understand right, a desideratum for a long time, I beg to suggest whether the inclosing them in cases of thick glass (such as what, I believe, are called bulls' eyes are made of) with hinges to admit of their being taken out and regulated, would not answer the purpose better than the wooden boxes now made use of? An answer to this question from some better judge than myself will oblige

W. W.

CENTRE OF GYRATION.

Let two spherical balls be made of different metals, as suppose of gold and silver, but exactly of the same weight and size; so that the gold ball may assume the form of a spherical orb or hollow sphere: now, if these balls be painted white, by what method can it be ascertained which is the golden ball and which the silver one?

Solution.

It has been ascertained by writers on fluxions, that the centre of gyration of a solid sphere is nearer to its centre than that of a hollow one of the same diameter and quantity of matter is to its centre. And indeed it is evident; because the inertia of each is as its quantity of matter multiplied by the square of its distance from the centre. Now, in the proposed gold and silver balls, the entire mass of the former is posited towards the surface, and its distance from the centre is greater than that of the latter; and as these masses are the same, it follows that the inertia of the gold sphere is greater than that of the silver one; whence arises the following mode of determination:—Let the two spheres roll down an inclined plane; observe that which rolls the quickest, or which has the greatest momentum in meeting the horizontal plane, for that is the ball of gold.

COMBINATION LAWS.

Extract from the Minutes of Evidence.

(Continued from p. 25).

Mr. Alexander Richmond farther examined in respect to the combination among the cotton-spinners, formerly mentioned—

How did the strike take place?—There were always general meetings of delegates from districts; these delegates met upon the day the decision was given, consequently they were all present, and returned to the districts, and gave intimation of what was the intention by a certain period; so that all the country were aware of it immediately on the return of the delegates, and the day was then fixed to make the attempt.

Do you not think such a system of organization is of a very dangerous character?—That point is the chief one on which I should have doubts; as to the alteration of the law, from my experience I think it possible (and more particularly in the large bodies where they are most demoralised) that there might be some risk; in the classes which are intelligent there is scarcely any; and I consider the rest would be in exact proportion as the people are uneducated.

Were you not tampered with to introduce the Luddite organization?—Repeatedly: attempts to introduce it were more than once made upon the committee, and then there were other attempts made amongst some of the minor delegates in some of the districts.

Have you not reason to believe also that agents were sent to tamper with you from France?—I cannot speak personally to that; but in 1817, in fact at the time that the combination prosecutions took place, I went to Lancashire, and a man was there introduced to me who had been two or three times tried at Lancaster; he had taken a decided lead in the Luddite organization, and on his authority I believe I have stated he himself had repeatedly received considerable sums that he believed came through that medium; but I can only rest it upon the authority of that particular individual. That he was active in the organization I knew, and that previous to that he had no means of making the appearance that he afterwards did.

To which member of the (Glasgow) committee did the Luddites make their communication?—Their letters were addressed to the secretary of the committee, and they had several times emissaries through all the counties.

In the great combination you were connected with, was there any mixture of political opinion?—Not at all: it was altogether a commercial question, and wholly unconnected with politics.

From the whole of your experience, do you conceive that the repeal of the powers exercised by the Court of Justiciary in Scotland, would mainly remove the ill-will and irritation which now exist between masters and men, and prevent any serious combination in future?—I would wish to answer distinctly, that in my own experience, in all the cases that have come under my knowledge, if the parties had been left to settle the matter between themselves, no irritation would ever have been excited. I would answer farther, that the evil resulting from the operation of the Combination Laws may require some time to restore society back to the situation in which it was. As far as I have observed, the consequences of the irritation which has taken place would have been more easily prevented than cured.

Has been in Ireland upwards of seven years, at different periods. Believes the combination question in Ireland amongst trades may be confined to Dublin almost wholly. Knows that combinations have always existed in Ireland. A number of them are in regular correspondence with London, the cabinet-makers for instance. The upholsterers, the boot, and the shoe trade are connected all over the kingdom.

The prices in Ireland, however, sometimes vary from those in England. Knows the linen trade in the north of Ireland perfectly well; but no combination has ever existed there, nor is it necessary, because the character and condition of the population is very different; it is partly agricultural and partly manufacturing. The linen trade there is spread over the country in cottages, and not carried on by great bodies of workmen.

Thomas Martin examined—

Is a master carpenter and builder. Has been in business at the west end of the town for three and twenty years. As apprentice and master has known the trade ever since the year 1783. There is a master carpenter's society for considering of the prices to be paid to workmen, to which witness has belonged for fifteen years. Attended a meeting of them in 1810, at the Crown and Anchor tavern; a greater number were then present than he ever saw at any one meeting. Provisions were then very high, and the men wanted an advance of their wages. As far as witness could judge of the general feelings of the meeting, they all thought the men had a right to have their wages advanced, but we did not know how we should be able to remunerate ourselves. The oldest master then in London said he thought they ought to have 5s. 6d. a day, if we could repay ourselves. The wages at the time these men struck were 26s. and 28s. per week; they demanded 32s, and it was generally settled at 30s. The rise was considered reasonable, on account of the rise of provisions. The carpenters' wages had been generally nearly on a par with that of other artizans; as the carpenters were advanced, the bricklayers and plasterers advanced also.

At the masters' meeting to which you allude, have they any common purse, or how do they defray the expenses?—I think it is nothing more than a wine or a punch club; they have no common purse, nor combination to support each other at all. I was very much harassed, and never had a penny support from it in any way.

The wages as fixed continued till February 1816, when another meeting of masters was held at the Free-masons' Tavern. Witness was in the chair. A number of the masters had reduced their wages from Christmas, or thereabouts; witness had heard of three or four or more who had done so, and therefore spoke to his men on the subject; he named to them several that had reduced their wages from 30s. to 27s. and 28s., and witness wished also to do the same, thinking it reasonable that as provisions were cheaper, wages should be reduced. The men, however, were dissatisfied at receiving 28s., and only remained with witness for about a month at that rate. In consequence of this state of things, that meeting of the master carpenters' society took place at which witness presided. About seventy were present. It was a special meeting on this business. The society or wine club meets regularly once a month; they have rules, a president, treasurer, and secretary. Was president in 1817, not in 1816. Minutes are taken of their proceedings. The society does not include one-fifth or one-fourth of the master carpenters in London and Westminster. They meet to take the price of timber and deals; they print a card of the rate, and the price to be charged accordingly; but that card is not attended to by surveyors in general. They print also a card of the wages, that is, what the masters are to charge their customers, but not what they are to pay the men. They never take it into consideration what they are to pay the men; no, not a word about it; it is merely asking what you pay, or I pay. If the average is 28s. or 30s., we regulate the price per day in proportion. The whole of the card prices are only applicable to day-work. The intention of the special meeting at which witness presided was to satisfy the minds of the men that the masters had not taken advantage of them by reducing their wages, and the way it was done was this—the masters used to charge six shillings the day for work done for their customers, and then they reduced their charges to 5s. 6d., while they only reduced the men fourpence. The men said, "You reduce our wages, but you have not reduced your charges;" and it was necessary to convince them that we had not taken any advantage. They met to convince the men that they had reduced their own charges, and not to settle the wages of the men.

You are quite convinced that no resolution was come to to reduce the wages in a week?—Yes, I am.

What followed on that, with regard to the wages,—was any reduction made after that time?—We had made a reduction previously to that; I had my men at work for a month or more upon the reduced wages of four-pence a day.

Was any *understanding* come to at that meeting, that all of you should reduce alike?—No, there was no such resolution entered, *nor any general understanding*. We were in hopes that the men would be satisfied; that was the only purport of that meeting.

What *had* you done?—*We had reduced them generally; it had gone nearly all through the trade.*

Was the object of that meeting that you should all make the same reduction?—The *intention* was to do it; but there was no such resolution passed.

Recollects that the person who is now treasurer of the club, said, "Mind what you are about, you will be subject to a prosecution if you publish any thing." All that was published was a resolution, stating that the masters had reduced their charges from 6s. to 5s. 6d. to their employers. There were a great quantity of hand-bills and remonstrances printed and circulated on the occasion by the men. Soon after the meeting of the masters, the men met at the Jew's Harp, and came to resolutions. The men entered a prosecution against the masters for a conspiracy. Witness was obliged to attend at Hatton Garden; but the men failed in proving it a conspiracy; they could not produce evidence that the masters had agreed to make a reduction in their wages; they could not prove it; and the magistrates squashed the information altogether. Four others were summoned to Bow-street, but the men failed there also. The difference between the masters and the men at this time continued for a month or five weeks. The men came to work at the 28s; some were reduced to 27s. and very inferior hands to 26s. Witness does not think the Combination Laws have any effect to prevent the combination of the men to raise their wages; they are so inefficient that the masters do not attempt to avail themselves of them. In 1807 the master carpenters entered prosecutions, which ended with an enormous expense, and they did not succeed at last. The men got their wages advanced. Believes that there has been no prosecution since that period against the men. Considers that the Combination Laws are useful neither to the masters nor men. They only drive the men into societies to raise a purse whenever it is necessary to raise their wages. This is the opinion of the masters generally, such at least as witness has conversed with. Knows of no harm that could result from the repeal of these laws. The masters consider them rather oppressive than otherwise. Conceives it would be a wholesome thing to try and leave the masters to make the best bargain they please. The combinations among the men have been attended sometimes with violence; in 1816, when there were some men who would have remained with witness, the others would not allow them; they came into the shop and destroyed their tools. Does not think acts of violence like this would take place if the existence of the Combination Laws did not drive men into combination clubs; and that is the opinion of the masters witness has met; they think the clubs the cause of it, and that the matter would go on quietly without them.

Supposing the Combination Laws were repealed, and the men were to require an advance of wages, with which the masters would not comply, are you not of opinion the men would be as likely to form combinations then for the purpose of attempting to prevent others working, as at present, and inducing the masters to comply with their terms as they do now?—I should suppose the common law would prevent men from assaulting one another, or committing a trespass.

Would they not be as likely to form combinations then?—Yes, but the law would be open to both, and thus would communicate openly with each other.

Is not the law equally open to both parties now?—Yes, it is open; but the Combination Laws prevented any union amongst the masters; for in this prosecution of the society, they were so much afraid of being taken hold of by the Combination Laws, that they would not pay a farthing towards these prosecutions; each paid their own expenses.

Then you think the Combination Laws act more severely against the masters than the men?—Yes, that is my opinion of it.

Mr. Isaac Seabrook, Master Carpenter and Joiner, Leather-lane, examined—

Describes the nature of the masters' club nearly as done by the preceding witness. They subscribe so much per month—believes about two shillings; but the object of that is merely to pay for their meeting-room and other incidental expenses. The list of prices is issued twice a year, at Christmas and Midsummer.

There are certain men selected from the body, who have a meeting previous to the general one, to form and recommend such prices as should be charged to the public. There are no resolutions come to at the general meetings. It is mentioned by the chairman that those prices have been properly looked into, and so and so is recommended to be charged. The list of prices is printed and sold, not only to persons belonging to the society, but to every master carpenter who may choose to apply to the secretary for it. The trade is in general guided by this table; they think it is properly looked into by men of experience, and that the charges are fair. The last combination that took place in the carpenters' trade was in 1818. The men wanted an increase of 2s. per week beyond what had been previously paid and agreed on in 1816 at the meeting, when Mr. Martin was in the chair. Some of the masters complied, others did not; but after a short time the increased price of 2s. was generally given. The men have in most cases obtained their object as to the rate of wages. They have regular funds, and a regular management of them much better than the masters. Thinks no injury would result from the repeal of the Combination Laws altogether; the clubs would continue as they are now; it would neither do good nor harm. Is of opinion that masters and men should be left at liberty to make what engagements they please, with this qualification, that there should be a summary power to compel workmen to complete all contracts. Sees no objection against the men combining together to advance wages, or the masters to resist it, provided both parties keep the peace.

(To be continued.)

[Evidence of the men as to the combination in the Carpenters' trade, in our next.]

MUSIC AND LIGHT.

The strong affinity between the seven primary colours and the seven natural notes of music has been already twice adverted to in our pages (p. 382, Vol. I, and p. 26, Vol. II), and we have now to supply the fuller illustration promised on the last of these occasions.

Of the use of the prism in analyzing the rays of light most of our readers are probably aware. If a ray be let through a hole of half an inch diameter, into a room lined with black cloth, and perfectly impervious to all light except what passes through the hole, and a prism intersect it as at *a*, in Fig. 1, of the annexed engraving, the ray will cease to go forward in the direction *c d*; it will be decomposed, and

Fig. 1.

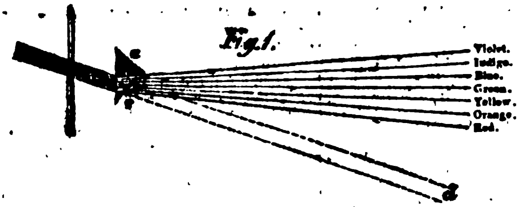


Fig. 2.

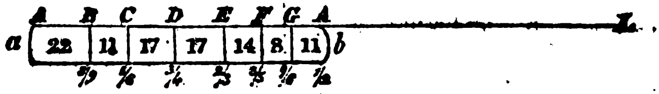


exhibit on a white screen a beautiful spectrum, consisting of seven primitive colours, viz. red, orange, yellow, green, blue, indigo, and violet (as indicated in the engraving). The edges of the adjoining colours seem to melt into or mix with one another, which makes the line of distinction between one colour and another not well defined, unless the experiment be made with very great nicety. This definition of limits was, however, effected by Sir Isaac Newton, who found that the width of each colour was agreeable to these numbers, viz. red 11, orange 8, yellow 14, green 17, blue 17, indigo 11, and violet 22: this is supposing the length of the spectrum of colours to be divided into 100 parts. Fig. 2 will more particularly illustrate this. If the prism be held perpendicularly to the ray, and turned, the spectrum will be seen to rise above and fall below a place, where it will seem inclined to stop; when fixed at that place, the spectrum will be perfect, and if measured and divided into 100 parts, each part will bear a proportion to another as the spectrum *a b*, fig. 2. These intervals moreover will be found to answer to the intervals of the diatonic scale of music; thus, if A L be a musical string, divided into two equal parts, the half A A will be an octave to the whole string; and if that half be divided into 100 parts, twenty-two of those parts will make the interval between A and B, and answer to the breadth of the violet colour. Eleven of the same parts will make the interval between B and C corresponding with the indigo, &c. These intervals may also be represented by the aliquot parts of the string A L; thus A B is eight-ninths of its length, and forms the boundary of the violet; A C makes five-sixths of its length, marking the limit of the indigo; A D is three-fourths of the line A L, and marks the extent of the green colour, and so on.

PRUDENTIAL MAXIMS.

If you would be wealthy, think of saving as well as getting.

It often costs more to maintain one vice than to bring up two children.

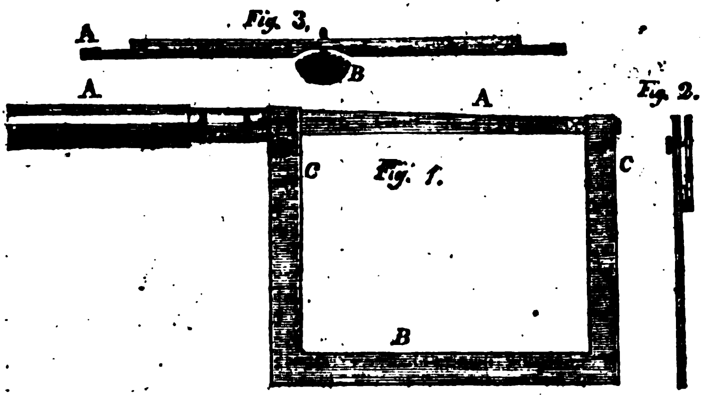
If goods are sold ever so cheap, and you do not need them, they are too dear for you to purchase; for if you buy what you do not need, you soon may have need to sell your necessaries.

TALLOW CHANDLERS' BOILERS.

21, St. John's-lane, Clerkenwell,
March 30, 1824.

Gentlemen;—In your Number of Saturday, March 20, under the head of "Discoveries and Improvements," it is stated that a Mr. Fothergill has lately invented an ingenious mode of erecting tallow-chandlers' boilers, so as to destroy the offensive effluvia. I beg leave to say the method is not a new one. For I am now, and have been for more than 20 years, in the constant practice of erecting them on the very same plan, for most of the principal tallow-chandlers in London, and in many parts of the country.—Your obedient servant,

W. Webb.



IMPROVED PIVOT FILE.

Watchmakers and persons employed in fine pivoting, generally find it impossible to file a pivot quite flat and true; but with the use of a frame, such as is described in the above drawing, attached to the file, the difficulty is completely obviated. This improvement was used in a shop where I was some years, but never seeing it any where else, I suppose it is not in general use.

Fig. 1, A A, represents a pivot file; B the frame, made of thin brass; C C screws to fasten the frame to the file.—Fig. 2 is a profile view of the frame.—Fig. 3 is the arbor, A the place to lay the pivot on, and B the screw to adjust the height of the frame.

The file being placed on the pivot, the frame rests upon the screw in the centre of the arbor, which being pressed close, must naturally keep the file flat; it is best to have a frame also for the pivot burnisher.

KENT.

MANUFACTURE OF FLOUR.

The mill-stones used in this country are made of French buhr. It is a stone far superior in every point of view to any other yet discovered; it possesses the property of cutting the grain freely with an almost imperceptible loss of substance, and acquires by friction, when in action, a polished or sort of glazed surface, which conduces much to its superiority.

When the stones are dressed, the cracks or indentations made by the tools or mill-bill form so many sharp cutting edges over the whole area, and these being made in parallel lines to the furrows, form a series of acute angles with each other when the stones are in a working position, that is, the lines in the upper stone or runner form angles with those in the lower or bed-stone; the lines in the runner, when in action, passing those in the other stone, similar to the edges of scissars or shears, whereby the bran is produced broad, and effectually cleared without being torn to atoms.

The Tuscan stones are, we are informed, very soft, and always preserve a degree of roughness, *even after a long-continued friction;* consequently they never can be brought to such a surface as the French; hence they present a rough face to their work; and instead of the flour being cut from the bran, as noticed above, the whole grain is rubbed to pieces by friction (which, experience has taught, always injures the quality of the flour), thereby producing the very effect these stones are said to obviate, namely, by tearing and reducing the bran: to avoid this result, however, recourse is had to a process to give the bran tenacity, and which I have no doubt was the original cause of soaking the grain, and grinding it in a partially dry state; otherwise it is difficult to explain why a practice so injurious to flour should have been adopted. From the circumstances of these stones retaining their roughness even after a long-continued friction, it is evident that particles are very freely detached from their faces, and a more rapid loss of substance takes place than with ours; consequently a greater proportion of grit will be unavoidably mixed with the flour. The convexity and concavity of their stones are worse than unnecessary, as the difficulty of keeping them so nicely true is too great for practice; whereas a perfect flat surface is readily obtained, and centrifugal force is quite sufficient to impel the meal to the circumference, where it escapes. So much, then, for this antiquated method.

I shall now proceed to remark on wheat, and what what should be observed in reducing it to flour.

The *quality* not only varies from difference of soil, but is considerably effected by the season in which it is produced; and its *condition*, likewise, depends on the season, the judgment that secured it at harvest, and the particular time of year when used.

Wheat of very large grain, though even in size and well filled, neither works well nor produces the best flour; but grains of a moderate and even size, well filled, thin skinned, and in good condition, will be found far superior; and a mixture in the proportion of two sacks of white to one of red, will make the best loaf-bread flour.

Hence it appears, from the great diversity of quality and condition, that some judgment must be necessary in the operative miller in preparing the stones for work; great care should be taken never to suffer them to lose an exact level, or get out of flour, as it is termed, otherwise they cannot do their work well; and to reproduce such a surface, will require the glaze to be taken off; consequently the mere effect of the Tuscan method will be the result, until a new face or glaze is acquired. A good miller, when preparing the stones, will prevent this, by doing as little as possible to those parts which may be more soft, while the hard parts will be kept down by lying in the work rather heavy.

If wheat works free and well, the cracks or indentations should be perfect, but very slight, and not too close together; and in proportion as the grain may be out of condition, so much more close and deep should these indentations be: an indentation is produced by one blow of the mill-bill only, which breaks through the glaze more or less deep, according to the force employed.

I must here observe, that the excessive heat acquired by meal, while between the stones, is caused in a great degree by the negligence of millers in driving them too long after the indentations are worn out, or their power of acting is at an end, as they are then obliged, in order to clean the bran (though then very imperfectly) to reduce the distance between the stones, whereby so much friction is produced as to cause this effect, and likewise to injure the flour.

I have seen the new patent portabl mills, and am inclined to think favourably of the idea, though I do not approve of their work; but an improvement may be made, and then, in all probability, they would produce the desired effect. G.

Fieldgate-street, March 8.

POWER OF STEAM-ENGINES.

The power of Steam Engines is in the compound ratio of the area of the piston, and the length of the stroke. But, as a perfect vacuum cannot be made, and there is a great friction of the piston in the cylinder, air-pump, &c., the actual labour is only about $\frac{2}{3}$rds of the calculation by theory. For my own part I take it to be $\frac{4}{10}$ths of 15 lbs. for atmospheric engines, * ths of the sum of the weight per square inch on the safety valve, and (15 lbs.) the weight of the atmosphere per square inch for engines with a condenser, and ·6 of the weight per square inch, on the safety-valve of high-pressure engines.

Those who do not agree with the above calculation, may use this general formula, viz. multiply the square of the cylinder's diameter by the number of pounds you (wish to) call working pressure; divide this quantity by 1·2733, the quotient will be the number of pounds the engine is capable of applying to machinery.

Ex. I. (p. 230, Vol. I.)—Piston, 32 inches diameter.

32^2 = 1024 × ·7854 = 804·25 = area (Sq. in.);
for atmospheric engine $\frac{9}{15}$ of 15 = 9 = lbs. working pressure;

7238¼ = lbs. the engine will lift;
× by piston .... 6 = length in feet;

43429½
× by No. of strokes per min. = 14

608013 = No. lbs. raised 1 foot high per min.

Ex. II. (p. 230, Vol. I.)—Engine of Double Power, not High Pressure.

28^2 = 784 × ·7854 = 615·75 = area (Sq. in.);
suppose 2½ lbs. per square inch on the safety-valve;
2½+15 (atmosphere) = 17·5, and ·6 of 17·5 = 10·5 lbs. working pressure;
615·75 × 10·5 = 6465·875 = lbs. the engine will raise;
20 double strokes, of 6 feet each, is 20×2×6 = 240 feet per minute;
6465·875 × 240 = 1551690 lbs. raised 1 foot per minute.

To find the number of horses equivalent to this power, which "Gulielmus" requests at page 239.

Messrs. *Boulton and Watt* suppose a horse capable of raising 32000 lbs. avoirdupois one foot high in a minute, Dr. *Desaguliers* computes a horse's power to be 27500 lbs., and Mr. *Smeaton* only 22916 lbs.

$\frac{1551690}{32000}$ = 48½ horses, by Messrs. *Boulton and Watt.*

$\frac{1551690}{27500}$ = 56½ horses, by Dr. *Desaguliers.*

$\frac{1551690}{22916}$ = 67¾ horses, by Mr. *Smeaton.*

N. B.—In this calculation, it is supposed that the engine works only eight hours (a horse's day); so that if the engine works 24 hours per day, it would be equivalent to three times the number of horses found by the above calculations.

In answer to W. (p. 300), I will first suppose his engine to be on *Boulton and Watt's* principle, and equivalent to 10 lbs. per sq. inch, working pressure.

14^2 = 196 × ·7854 = 153·9384 = area;
× effective pressure = 10 = lbs.

1539·384 = lbs. the engine will lift.
44 × 2 × 2·5 = 220 feet piston moves per minute.
1539 × 220 = 338580 = lbs. raised 1 foot per minute.
$\frac{338580}{30000}$ = 11¼ horses, of eight hours per day.

Now, suppose this engine to be on high-pressure principle, and loaded with 50 lbs. weight per square inch on the safety-valve, those engines working entirely by the force of steam, the pressure of the atmosphere does not come into account; therefore it will be

$$14^2 \times \cdot 7854 = 153\cdot 938 = \text{area};$$
$$\times \cdot 6 \text{ of } 50 = 30 = \text{lbs. pressure};$$

$$4618\cdot 14 = \text{lbs. the engine will lift};$$
$$44 \times 2 \times 2\cdot 5 = 220 = \text{feet piston moves per minute};$$

$$1015990\cdot 8 = \text{lbs. raised 1 foot high per minute.}$$

$$\frac{1015990\cdot 8}{30000} = 34 \text{ horses' power in eight hours.}$$

To find the altitude of a column of water that will feed the boiler of any engine, is only to multiply the number of pounds weight on one square inch of the safety-valve, by 2·304 or 2·3 for practice; thus, 3 lbs. per inch on a safety valve, requires 6·9 feet altitude above the water in the boiler; 50 lbs. requires 115 feet, which accounts for the necessity of a forcing pump to high-pressure engines.

WM. ANDREWS.

Tring, Herts.

ACCOUNT OF THE ODOMETER, AND THE INVENTOR, HOHLFELD.

An *odometer* is a machine by which the steps of a person who walks, or the revolutions of the wheel of a carriage may be counted, and by which the distance that one has travelled may be ascertained. Vitruvius mentions a machine of this kind, and which he thinks might answer for a ship. From a carving in the palace at Urbino, it is evident that this machine was known in the fifteenth century. In a treatise of mechanical instruments, published at Frankfort, 1604, mention is made of an odometer, without naming the inventor.

The emperor Rudolphus II, who reigned from 1576 to 1612, had two very curious odometers, which not only pointed out distances, but also marked them upon paper by the way.

One Butterfield, in England, invented an odometer, which was greatly esteemed. But an artist named Hohlfeld, born at Hennersdorf, in the mountains of Saxony, in 1711, constructed one upon better principles, and brought it to such perfection, that he may be with justice denominated the inventor of this singular machine. He was a man of such rare talents and of such benefit to the public, that the following brief sketch of his life may be acceptable and stimulating to that class of society for whose instruction and amusement this work is devoted. It was originally written by Professor Muller, at Berlin:—

Hohlfeld learned the trade of lace-making at Dresden, and early discovered a taste for mechanical pursuits, by constructing several kinds of clocks. To improve in his trade, he removed from Dresden to Berlin. He soon became an excellent workman, and invented several machines for shortening his labour, which afforded him leisure to pursue his mechanical studies. The result was, that during that period he constructed several air-guns and clocks.

In 1748 he had the good fortune to become acquainted with the celebrated Sulzer, at whose suggestion he constructed a machine for noting down any piece of music when played upon a harpsichord. A machine of this kind had previously been invented by Von Unger, but Hohlfeld had never seen it. In two weeks this untaught mechanic, without any other assistance than the vigour of his own genius, completed the machine which Von Unger himself could not, through want of an artist able to comprehend his ideas. This machine is now in the possession of the Academy of Sciences at Berlin, and by means of a drawing it was introduced into England. But though this invention was universally applauded, yet none had the generosity to reward the ingenuity and industry of the inventor.

About 1756 the Prussian minister, Count de Podewils, employed Hohlfeld chiefly for the purpose of constructing water-works in his magnificent gardens at Gusow. There he invented a well-known threshing-mill, and another for chopping straw with more expedition. He also constructed a machine which, being fastened to a carriage, indicates the revolutions made by the wheels. It will be admitted that such a machine was invented before, but his was upon better principles, and more accurate and simple. Sulzer used this machine in his tour, and found that it answered the intended purpose.

In 1765 the duke of Courland visited Hohlfeld in Berlin, and offered him a pension of 800 rix-dollars to remove to Courland; but this ingenious man was so content with his condition, and so much attached to his friends, that he declined acceptance of such an enticing offer. Informed of his conduct, the king appointed him a pension of 150 dollars.

He also constructed several other machines, and among them one for weaving figured stuffs, so contrived that the weaver had no need for any instrument to shoot through the woof (which is still in the possession of the academy of that place); also, a pedometer for carrying in the pocket; a convenient and simple bed for a sick person, which was of such a nature, that the patient with the smallest strength could at any time rise or lower the breast, and, when necessary, convert the bed into a stool; and a carriage so framed, that if the horses took fright or run off, the person in it could, by a single push, loosen the pole, and set them at liberty.

Every machine that came under the inspection of this singular man, he altered and improved in the simplest manner. He made and repaired all his own instruments. But as he was fonder of inventing than imitating the inventions of others, he constructed them in such a manner that none but himself could use them to advantage. Several of his inventions were copied, but in a very clumsy manner.

His conception was almost instantaneous, and when he conceived the idea, he instantly put it in execution. In a moment he comprehended what was proposed, and discovered whether or not it was practicable; and if he was convinced that it was not practicable, neither money nor advice could prevail upon him to make the attempt. The same rapidity of conception that he displayed in mechanics, he displayed in all other pursuits. His observations upon most subjects were not only judicious, but peculiar to himself, so that without exaggeration, it may be said that he was born a mechanical philosopher.

With regard to moral character, which always ennobles every man, he was very different from the generality of the same class in society. Though he still retained a tint of his original manners, yet his mild and civil deportment rendered his company and conversation agreeable. His life was sober and regular, and his heart was good. Though he was every day invited to the tables of some one in high rank, yet he staid for the most part at home, preferring domestic to foreign pleasures. He went to market for his own provisions, which he cooked, and was as contented over his humble meal as Curius was over his turnips.

A little before his death he had the pleasure of seeing a curious harpsichord which he had constructed purchased by his Prussian majesty, and placed in an elegant apartment of his palace at Portsdam. Having for some time neglected this instrument, the vigorous application that he bestowed in putting it in order, brought on that disease which proved fatal. His favourite clock being disordered during his illness, he could not be persuaded by his friend and physician, Dr. Stahls, from repairing it. Close application occasioned some obstructions, which were not observed until too late, and he died 1771, at the house of Count de Podewils, in the 60th year of his age. Although he left no son either to imitate his virtues or rival his genius, yet the productions of his inventions will immortalize his name, and serve to strike the fire of genius from the minds of other industrious mechanics.

INQUIRIES.

No. 8.—PRIME NUMBERS.

Gentlemen;—While looking over the 1st Vol. of Dr. Hutton's edition of Montucla's Mathematical Recreations the other day, I accidentally turned to that page wherein he treats of prime numbers (and following which, he gives a table of all those below 10,000); he states that no prime number, except 2, can be an even number, nor any of them terminate in 5, except itself; consequently they must all end in 1, or 3, or 7, or 9; he farther states a curious property of prime numbers, which is, that every prime, 2 and 3 excepted, if increased or else diminished by unity, is divisible by 6, and gives illustrations of 5, 7, 11, 13, 17, 19, 23, 29, 31, &c.; but he also observes, the inverse is not true, that is, every number which, when increased or diminished by unity, is divisible by 6, but not, on that account, necessarily a prime number.

I should therefore be much obliged by some of your correspondents giving a certain and expeditious rule for ascertaining whether any number terminating in 1, 3, 7, or 9, be a prime number or no, without the tedious trouble of dividing it by every number in succession, as far up as its square root.

ABACUS.

P. S.—It is scarcely necessary to remark, that a prime number is one which cannot be divided (except by itself or unity) without leaving a remainder.

No. 9.—KENTISH RAG-STONE LIME.

Maidstone, Feb. 5, 1824.

GENTLEMEN,—Can any of your scientific readers, who are acquainted with lime-burning and mortar-making, give, through your useful publication, a description of the most economical and approved form of a lime-kiln for burning the hard Kentish rag lime-stone into good lime, the best fuel to be used for that purpose, and the proper quantity of sand to be added to lime, for the purpose of making it into good mortar; together with the best form of a mortar-mill for grinding the same? From the foundation of a Roman building lately discovered, in trenching a hop-field, belonging to Hilstead farm, in the parish of East Peckham, near the Medway, it appears that the mortar used in constructing this building, was made from rag lime-stone; and although it cannot be less than 1,500 years since the building in question was erected, yet the bricks and mortar of which it is composed, are cemented together harder than Scotch granite—a circumstance which plainly shows that the stone in question has been used heretofore for the purpose of making mortar of the very best quality, although its use is now so far superseded by chalk, as to render doubtful the best mode of burning it, or the quantity of sand to be used with it, when burnt, for the purpose of making it into good mortar.

A MASON.

A LONDON BREWERY.

An idea of the immense extent to which the brewing of porter is carried on in London may be formed from the following description of Barclay's brewery. If any private concern in England, or in the world, is entitled to the epithet of vastness, this is one. It covers about eight acres of ground, and manufactured last year 351,474 barrels, of 36 gallons each. The building which contains the vats themselves, are enormous. The largest of the latter contain each 4,000 barrels. The average number of vats is nearly 100. A steam-engine of 22 horse power is employed in driving the machinery, and about two hundred men are engaged in the various works of the establishment: it is supposed that the number of persons dependent upon it without doors, in the sale and transportation of the beer, is three or four thousand. The three coppers in which the beer is boiled, hold each 150 barrels.

Twenty-five gentlemen once dined in one of these coppers, after which, fifty of the workmen got in and regaled themselves. One hundred and ninety pounds of beef-steaks, were thus consumed in one day, in this novel kind of dining-room. The tuns in which the beer ferments, hold 1,400 barrels each. The carbonic acid in one of them stood about three and a half feet above the liquor, and poured over the side in a continued stream. A candle is instantly extinguished on being placed near the outer edge of this receptacle, and on holding one's face near it, a sharp pungent sensation is felt in the mouth and face, not unlike that produced by ardent spirits. An immersion of few moments would be fatal.

One hundred and sixty horses are kept on the premises, for the purpose chiefly of transporting the materials to and from different parts of the city. A finer collection of animals employed in one concern perhaps is no where to be seen.

This is, upon the whole, I believe, the largest brewery in London. It formerly belonged to Thrale, the friend of Dr. Johnson, who, as executor to the estate, sold the establishment to its present owners. One of the latter informed a friend of mine that the Doctor, in treating with them for the purchase, remarked in his characteristic manner: "Gentlemen, it is not merely these boilers and these vats that I am selling you, but the potentiality of acquiring wealth beyond the dreams of avarice."

R. A.

COMMON SALT.

This is found in large masses, or in rocks, under the earth in England, and elsewhere. In the solid form it is called *sal gem*, or rock salt. If it be pure and transparent, it may be immediately used in the state in which it is found; but if it contain any impure earthy particles, it should be freed from them. In some countries it is found in incredible quantities, and dug up like metals from the bowels of the earth. In this manner has salt been dug out of the celebrated mines of Bochnia and Wieliezka, in Poland, ever since the middle of the thirteenth century. In these mines, which are said to reach to the depth of several hundred fathoms, 500 men are constantly employed. Though the salt mines of Wieliezka, near Cracow, in Poland, have long astonished the philosopher and the traveller, yet it deserves to be remarked, that the quantity of rock salt obtained from the mines of Northwich, in Cheshire, is greatly superior to that obtained at Cracow.

Besides the salt mines here mentioned, where the common salt is found in a concrete state, under the name of rock salt, there is at Cordova, in Spain, a remarkable solid mountain of rock salt; this mountain is between 4 and 500 feet in height, and a league in circuit: its depth below the surface is not known. This mountain contains the rock salt without the admixture of any other matter. The waters of the ocean every where abound with salt, though in different proportions. Besides common salt, these waters contain several other saline combinations, such as muriate of magnesia, sulphate of lime, &c. The whole art of extracting salt from waters consists in evaporating the water in the cheapest and most convenient manner. In England, a brine, composed of sea water, with the addition of rock salt, is evaporated in large shallow iron boilers, and the crystals of salt are taken out in baskets. In Russia, the sea water is first frozen, and the ice, which is entirely fresh, being removed, the remaining brine is evaporated by boiling.

THE ARRACACHA OF SOUTH AMERICA.

We observe by the American papers that the distinguished botanist Baron de Shack has arrived in Virginia from Trinidad, with the intention of introducing a knowledge of the properties of the Arracacha, and the manner of cultivating this excellent vegetable. Those who are well acquainted with its qualities describe it as one of the most useful of all the vegetables in South America, its root yielding a food which is prepared in the kitchens in the same manner as potatoes. It is extremely grateful to the palate; so tender that it requires little cooking, and so easy of digestion, that it is the common practice where it is cultivated, to give it to convalescents, and persons with weak stomachs, being considered of a much less flatulent nature than potatoes. Starch, and a variety of pastry are made of its fecula; and reduced to a pulp, it enters the composition of certain fermented liquors, supposed to be very proper for restoring the lost tone of the stomach.

The Arracacha, though a native of Santa Fé, and other places in South America, thrives best in temperate climates. Its cultivation requires a deep black mould, and it is propagated by cutting the roots to pieces, each having a separate eye or shoot, and planting these in separate holes.

At the end of three or four months, the roots are of sufficient size and quantity to be used for ordinary purposes, and if allowed to remain in the ground for six months, they increase to a great bulk without their taste being any way altered. We understand the Arracacha has undergone such experiments in Scotland as to satisfy botanists there that it is much superior, in every respect, to the potatoe, which it is expected in a great measure to supersede. The potatoe was originally introduced into Europe from a warm climate, and has since become naturalized to the soil. In many parts of this country there can be no doubt the Arracacha might be cultivated with as much ease as the potatoe; and we hope therefore to see it ere long added to our articles of cheap food.

ECHOES.

An echo is a reflected sound. The ancient philosophers were unacquainted with the true nature of the echo. The poets supposed it to have been a nymph, who pined into sound for love of Narcissus. But the modern state of philosophy has established it upon unerring principles. According to the various distances from the speaker, a reflecting object will return the echo of several, or of a few syllables; for all the syllables must be uttered before the echo of the first syllable reaches the ear, otherwise it will make a confusion. In a moderate way of speaking, about 3½ syllables are pronounced in one second, or 7 syllables in two seconds. From the computations of a short-hand writer, it appears that a ready and rapid orator in the English language pronounces from 7,000 to 7,500 words in an hour; namely, about 120 words in a minute, or two words in each second. Therefore, when an echo repeats seven syllables, the reflecting object is 1,142 feet distant; for since sound travels at the rate of 1,142 feet per second, the distance from the speaker to the reflecting object, and again from the latter to the former, is twice 1,142. When the echo returns 14 syllables, the reflecting object must be 2,284 feet distant, and so on. A famous echo is said to be in Woodstock Park, Oxford. It repeats 17 syllables in the day-time, and 20 at night, when, the air being somewhat denser, the sound does not travel quite so fast. There is also a remarkable echo on the north side of Shepley church, in Sussex, which will repeat distinctly 21 syllables. At Rosneath, near Glasgow, there is an echo that repeats the tune played with a trumpet three times completely and distinctly.

MOCK SUNS.

On the 7th May, 1823, when the sun's lower limb had just dipped the water's edge at the Cape of Good Hope, the Rev. Mr. Fallows observed several parhelia, viz. four on the left and three on the right hand of the sun, and all cut by the horizon, like the real sun. They had the same shape as the real sun, and were as high, but not so long. When the upper limb of the sun came in contact with the horizon, it, and the mock suns, appeared as bright spots upon the water's edge, and then one of them instantly vanished.

CHLORINE.

The substance now known by the name of Chlorine to chemists, was, up to the year 1810, called by them oxymuriatic acid. The latter name was given to it on the supposition that it was a compound substance, consisting of muriatic acid and oxygen. A different opinion was first formed, perhaps about the year 1808, but it was in 1810 that Sir Humphry Davy published his account of the experiments he had made on this substance, whence the conclusion was drawn that it was a simple substance, to which the name of Chlorine was given from its yellow colour. Since that time the great majority of chemists have adopted the views of Sir Humphry Davy, and Chlorine appears in most of the elementary treatises on chemistry as a simple substance, classed along with oxygen, either from its electrical property, or from its being a supporter of combustion. It is a gaseous body, possessing all the mechanical properties of common air. Its colour, which is hardly perceptible by candle-light, is greenish yellow. Its taste is astringent. When breathed, mixed with atmospheric air, it produces a most insufferable sensation of suffocation, occasions violent coughing, with much spitting, followed by great debility; and if breathed in its pure state, it destroys life almost instantly. It possesses the very peculiar property of destroying all vegetable colours, and of rendering most substances white. This property has led to its employment as an agent in bleaching, and by it most of the cloths now manufactured in this empire are made of their dazzling whiteness. Mr. Scheele first observed this property in Chlorine; M. Berthollet, a French chemist, first recommended its employment in bleaching; and the celebrated Mr. Watt, of Birmingham, was one of the first persons to introduce it into Great Britain.—*Chemist.*

RIVER ON FIRE.

The editor of the Sparta, Tennessee, paper, mentions the novel circumstance of the Calf-Kill river being on fire at the salt wells of Wm. Denton. In boring for salt water in the bed of the river, the workmen struck upon a rock containing a vein of sulphurous gas. The gas soon ascended to the top of the water, agitating it, and passing off in bubbles—one of the workmen applied a torch to the gas as it rose from the river; it took fire, and burnt with great violence, ascending in a large column, 40 feet in height, and appeared to burn down to the very bed of the river. It had continued several days in this manner to attract the attention and curiosity of the surrounding country.

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Then let each man observe with care
  The wonders wrought by man's weak hand;
Nor let our scorn the worthless spare,
  Who ne'er such wonders understand.
Of highest genius 'tis the pride
  To comprehend what *Art* has done,
To know the law her steps that guide,
  And share the glories she has won.—*From the German of Schiller.*

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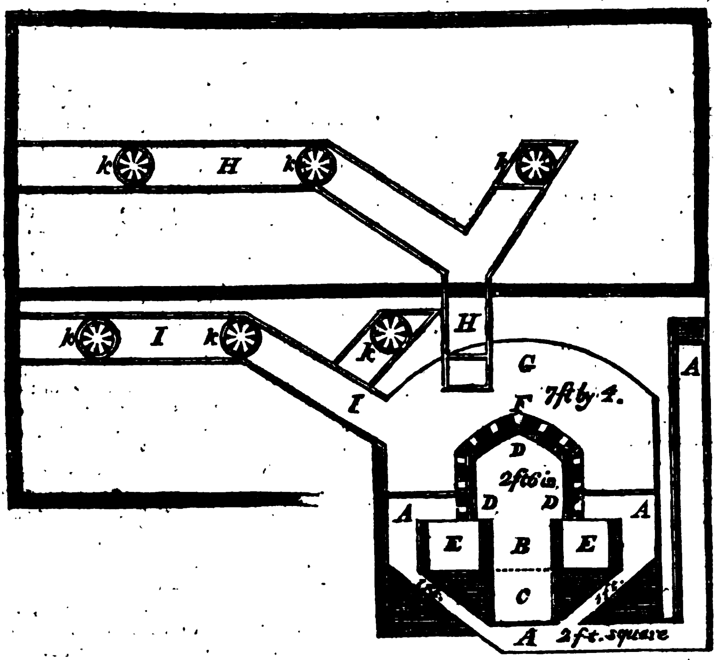


To the Editors of the Mechanic's Magazine.

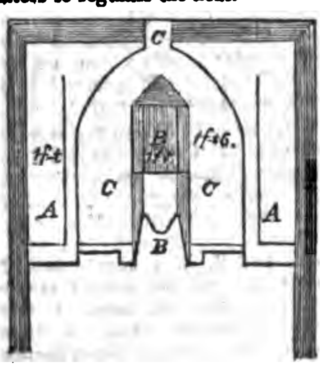
Lincoln, Feb. 17, 1824.

GENTLEMEN;—In answer to an inquiry from Mr. J. Fitch, in the 19th Number of your valuable Magazine, I beg to recommend as the cheapest, and by far the most comfortable method, that of heating a room of the dimensions stated by hot air-flues. I rest this recommendation on some little personal experience in the matter. For eight years I did business, daily, in a room 70 feet by 30 feet, and, during winter, with two very large fires; but the room was never comfortably warm ten yards from the fires. The mode of heating by flues was then adopted; and the same room, as well as another, 60 feet by 21, has been ever since (now more than four years) kept at a regular heat of 55 degrees by one fire, which supplies the flues with hot air. The saving, too, in fuel, is very great:

while four fires, on the old plan, for the two rooms, would consume 20 chaldrons yearly, this method requires only 8 chaldrons, making a saving of 12. The whole expense of laying down the flues, building the cellar, &c. was about £100; nor has any repair been yet found necessary. The work was executed by Mr. SAMUEL WALKER, *Builder*, *Nottingham*, to whom I beg to refer any one who may wish to make a trial of it, for further information.

The following rough description will, perhaps, make the mode of proceeding clearer to your readers:—

The drawing prefixed to this article shows the two rooms, one 70 feet by 30, and to the square of the roof 18 feet; the other, 60 feet by 21, and to the square of the roof 12. Also, a third apartment (the cellar beneath) containing the fire-place that furnishes the hot air to the rooms. A is the cold air flue; B, fire-place; C, ash-place; D, iron retort; E, smoke flue; F, 4½ inches brick-work round the retort, with small pots, similar to chimney-pots, 2 inches in diameter, to admit the cold air to the retort, and to let it into the hot air chamber, when heated; G, the hot air chamber; H, hot air flue into the large room; I, ditto into the small room; K, ventilators to regulate the heat.



The additional figure here inserted, is an elevation of the fire-place.

A is the cold air flue; B, the fire-place; and C, the smoke flue.

I am, gentlemen,
Your obedient servant,
J. W. K.

ON THE PREPARATION OF OAK-TIMBER FOR SHIP-BUILDING.

GENTLEMEN;—It is with great diffidence I enter upon a correspondence through the medium of the Mechanic's Magazine, as I do not feel conscious of any ability in that way, (being more used to wield a tool than a pen); but a letter in your 28th Number "On the Preparation of Oak-Timber for Ship-Building" induces me to it, in the hope of eliciting information on what appears to me wrapt in obscurity.

The writer of the letter says, the advantages to be gained by his plan, are, first, greater durability; second, a saving of one-third in quality; third, increased strength; fourth, greater ease, accuracy, and expedition; fifth, prevention of internal decay; and sixth, that the dry-rot is completely done away with: and the principal operation by which all this is to be accomplished, is sawing the tree down the middle. Now, this principal operation is the very thing that appears to me the most objectionable, as it will destroy the *size* of the timber.

Pray, how is a convertor to get timber 12 or 14 inches square, out of trees served in this manner; and for building large ships it is wanted of still greater scantling?

Timber brought from the forests in a sided state often proves unprofitable in the conversion, and likewise very troublesome to the convertor, from the loss of an inch or less in the siding down; and I am sure I do not know what could possibly be done, if all timber were to be served as proposed. With regard, again, to "saving one-third in quality," I do not really understand what he can mean; for the quality of timber is dependent on local circumstances; as, for instance, Welsh timber is not so good as Sussex, nor foreign oak equal to English oak; therefore I cannot exactly comprehend how any particular art of seasoning can alter the quality of it. As to "increased strength," I will admit, that if the quality can be improved by this method, the strength or tenacity may be.—"Fourthly, greater ease, accuracy, and expedition;"—to what does this refer? the conversion, or removal, or what?—"Fifthly, the prevention of internal decay;" and, "Sixthly, the complete removal of the dry-rot"—How has either of these points been ascertained? for it is said in the letter, "that it has not been tried yet for this purpose." As your correspondent begs that upon this ground, it ought not to have a premature condemnation, so ought he not to draw premature conclusions. I shall feel obliged to your correspondent for any information, having been concerned in a series of experiments on the same subject.

I remain, Gentlemen,

Your humble servant,

NAUTICUS.

WHEEL CARRIAGES.

In consequence of my communication respecting wheel-carriages, inserted in your 28th Number, I have been favoured with a letter from an intelligent gentleman in Scotland, expressive of his satisfaction on the perusal thereof, and his wishes for the result of *farther* experiments, either by letter or through the medium of your valuable publication, which latter mode (with your concurrence) I the rather prefer, as by that means others will have the opportunity of seeing, and I hope *improving* on them, which, should they so do, I trust they will, *pro bono publico*, communicate such improvement to you.

The experiments above alluded to, were made many years ago, merely for my own satisfaction, and probably not with the greatest possible accuracy. I certainly have not exhausted the subject, and am happy to find it noticed by others. "A *whet-stone* is not a *cutting* instrument, but it sharpens such," and is therefore *useful*; and if my few hints should tend in the least ultimately to lessen the labour of cattle, &c. I shall enjoy the satisfaction of having done something towards it.

I consider the letter of my correspondent to be another "spoke in the wheel," and therefore transcribe it almost verbatim, in doing which, I have no fear of incurring his displeasure, as from the tenor of it I think I may fairly infer, that he will be happy to see it made public. He says, "I have long been of opinion that the splinter-bar, or point horses draw from, in waggons and other carriages (particularly those drawn by *one* pair of horses a-breast) are too high, as they are, in general, nearly equal to the point of draught at the horse's shoulder, which is above the centre of the wheel; therefore part of his strength is lost, as he pulls down the wheels to the ground.* Were the line of draught equal (level) with the axletree, I am convinced that the horse would exert his strength to more effect. I consider this of still more importance in two-wheeled carriages with *one* horse, and am convinced of the truth of it from my own experience. For several years I drove a small pony in a light gig, made in the ordinary way; I then had it altered, so that the draught was horizontal with the axletree, and I found that the pony did his work with *more ease*. Having then no public mode of communicating the improvement to others, I contented myself with the advantages I enjoyed." Thus far my correspondent, with whom, but for the "Mechanic's Magazine," this would probably have rested.

I am sorry to inform my correspondent, that I am not at this time prepared to gratify his wishes, as my "model waggon" has long since been demolished, by being used as a play-thing by my children; but if, in a short time, I should not see the subject taken up by a more able hand, I will furnish myself with another model, and carry the experiments

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* Emmerson, in his "Principles of Mechanics," says, that a horse draws with the greatest power when the line of draught rises *above* the horizontal about 15 degrees. This I cannot at present prove or disprove; but if horses draw by a *fixed* pole, rising in the usual way, as mail-coaches, &c. I think this gentleman's opinion right, as they pull the wheels to the ground, which obviously increases the friction.

(as I now see there is ample room to do), much farther, and hope, by your kind indulgence, to give him and the public the results.

A gentleman in this neighbourhood informs me, that he knows a farmer who has his waggons made with the *fore*-wheels the *largest*.

If not incompatible with your plan, nor superseded (as I hope I may be by others), I intend communicating to you a few *thoughts* on the comparative power of draught-horses when *walking*, *trotting*, and *galloping*.

E. VIALLS.

Rothwell, Northamptonshire.

SHORT METHOD OF SQUARING ANY GIVEN NUMBER.

In squaring any number, for example 47653843, by my method, the work will stand thus:—

```
       47653843
   ----------------
   1649362509641609
           28592304
          3812304
         762448
        28590
       4760
      564
     56
   ----------------
   2270888752668649
```

In the above example, the first line is found by squaring each figure of the given number, taking care to assign two places to each square; so that if the square is less than 10, a cypher must supply the left-hand place.

The second line is found by doubling the *first* figure, and multiplying all the figures on the *left*-hand by this double: thus, 2 × 3 = 6, and 6 × 4765384 = 28592304.

The third line is found in the same manner by doubling the second figure, and multiplying the figures on the left-hand by this double, and so on till the end.

Obs.—Each product is removed *two* digits towards the left-hand, *except the first*, which is removed only *one* digit.

The saving in the actual number of figures by this method is 29; but the saving in time is much greater in proportion: this saving arises from the facility with which the first line is produced, from the *decreasing* labour of *carrying* during the multiplication of each succeeding line, and from the difference in the final addition sum.

AGRONES HEGRIO.

STEAM-VESSEL NAVIGATION.

London, March 22, 1824.

GENTLEMEN;—I am inclined to think that your correspondent, Mr. Henry Deacon, has, in some degree, misunderstood the Query inserted by me in your Magazine, p. 381; for I therein stated, that the united powers of wind and steam were each capable of propelling the steam-vessel six knots an hour, when *separately* applied; consequently (with all due deference), I am not at all aware that there was any necessity for my stating the size of the vessel, the power of her engines, or the velocity of the wind; seeing that the power made use of was adequate to the task assigned. Nor do I conceive, that being made acquainted with these particulars, will be of the least assistance to any one desirous of considering the question (tide or current being entirely excluded). Nevertheless, as your correspondent wishes it, I will extend my hypothesis, and suppose the vessel to be 500 tons burthen, drawing 17 feet water, and having two engines of 50 or 55 horse-power each; and that the velocity of the wind itself is 8 knots. I do not wish to be understood as inquiring whether these powers, as *now* stated, would propel a vessel, when *separately* applied, at the rate before mentioned; but at what rate she would go through the water with the assistance of *both* powers.

I am perfectly satisfied, in my own mind, as to what a vessel would do under such circumstances; though, at the same time, I am open to conviction, and most anxious for the opinion of those who may have had *actual* experience on the subject.

I am, gentlemen,
Your obedient servant,

E. S. C.

ENORMOUS TAX ON TEA.

To the Editors of the Mechanic's Magazine.

GENTLEMEN;—Though you have taken a considerable interest in the roasting of grain as a substitute for coffee, and have recommended this wholesome British beverage to your readers, I apprehend you have not converted them all, and that there are still some of them so obstinate as to prefer bohea and congou to burnt rye and barley. They may, perhaps, like to estimate how much they each contribute, while they indulge their favourite propensity to the support of that great building in Leadenhall-street, which is one of the ornaments of the city. To enable them to do this, you may possibly think the following extract from a late Number of the Edinburgh Review worthy of being submitted to your readers. The first table shows the price at which teas are sold by the India Company, and the second table the prices of the same sort of teas in America and Germany, where the tea trade is not monopolized. Of course the prices are independent of the duty paid to the crown.

Sale of Teas by the East India Company in March 1823.

Description of Tea.	Putting up Price.	Average Sale Price.	Quantities sold.
Bohea	1s. 6d. per lb.	2s. 5d. 2-10ths per lb.	451,118 lb.
Congou	2s. 2d.	2s. 6d. 3-10ths	1,675,872
Ditto	2s. 4d.	2s. 7d. 8-10ths	3,330,673
Campoi	2s. 9d.	3s. 5d. 3-10ths	166,207
Souchong	3s. 0d.	4s. 4d. 7-10ths	31,940
Twankay	2s. 5d.	3s. 4d. 6-10ths	1,139,522
Hyson-skin	2s. 6d.	3s. 3d. 9-10ths	60,216
Hyson	3s. & 4s.	4s. 5d. 4-10ths	221,935

Quantities of Company's Tea sold	7,077,483
Ditto, of private trade	606
Total quantities sold	7,078,089

	New York Prices in 1823.	Hamburgh Prices in 1823.
Bohea	0s. 8½d.	9d. 5-16ths to 10d. 3-16ths.
Congou	0s. 7½d.	1s. .... to 1s. 2d.
Campoi	—	10d. 7-8ths to 1s. ½d.
Souchong	1s. 3¾d.	1s. .... to 1s. 4d.
Twankay	—	1s. 5d. .... to 1s. 7d.
Hyson-skin	1s. 5½d.	1s. 5¾d. ... to 1s. 7d.
Hyson	2s. 6d.	2s. 2d. .... to 2s. 4d.

Which prices being compared with the Company's prices, give

	Excess of E. I. Company's Prices over those of New York.	Excess of E. I. Company's Prices over those of Hamburgh.
Bohea	1s. 8½d. per lb.	1s. 7½d. per lb.
Congou	1s. 11½d.	1s. 6d.
Campoi	—	2s. 5¾d.
Souchong	3s. 1d.	3s. 2½d.
Twankay	—	1s. 10½d.
Hyson-skin	1s. 10½d.	1s. 9½d.
Hyson	1s. 11½d.	2s. 2½d.

Now, it is evident that, by multiplying the quantities of the various descriptions of tea disposed of annually at the Company's sales by the *excess of price* at which they are sold over the prices of similar teas at New York or Hamburgh, we shall get the nett sum which the people of this country are compelled to pay for the teas used by them, over and above what would purchase an equal supply were the trade thrown open. The Company have furnished the means of making this computation; for it appears, from the statements in their annual accounts, that the sales of Bohea, in 1822, amounted to 2,419,046 lbs., which, being sold at an advance of 1*s.* 8*d.* per lb. (throwing away the fraction) over the price of Bohea at New York, cost 206,587*l.* more than it would have done, but for the monopoly. A similar computation being made with the other description of tea, the account will stand as under:—

	Quantities of Tea sold at Company's sales in 1822.	Excess of Company's price per lb. over prices at N. Y. or H.	Total excess of price received by the Company.
Bohea	2,419,046 lbs.	1s. 8d. N. Y.	£. 206,587
Congou	18,609,479	1s. 6d. H.	1 392,719
Campoi	196,720	2s. 5d. H.	23,871
Souchong	115,738	3s. 0d. N. Y.	17,360
Twankay	4,036,445	1s. 10d. H.	368,907
Hyson-skin	180,420	1s. 3d. H.	11,411
Hyson	306,697	2s. 0d. N. Y. and H.	30,469
	25,874,546		£. 2,058,815

This quantity is, however, exclusive of 2,019,019 lbs. sold at the same sales on account of the captains and other officers of the Company's ships. The sorts of tea belonging to the officers are not specified; but, supposing them to have been mixed up in the same proportions as those belonging to the Company, the excess of price on them will be about 160,000*l.*; making, in all, an excess of 2,218,000*l.*

These results are of the utmost importance. They are deduced from documents whose accuracy cannot be disputed. And it appears, from them, that the monopolists of Leadenhall-street *obtained* 2,218,000*l.* *more for the teas sold by them in Britain, in 1822, than would have sufficed to purchase an equal supply had the trade been free!* Inasmuch, too, as very little variation has taken place during the last three years in the prices of tea at Hamburgh and New York, and as neither the prices nor the quantity of the teas sold at the Company's sales in 1822 perceptibly differ from the price and quantities of those sold in 1821 and 1823, it clearly follows, that the monopoly of the tea trade enjoyed by the East India Company costs the people of this country, on an average, not less than two millions two hundred thousand pounds sterling a year!

Thus, gentlemen, your readers will see, that for every pound of tea they drink, they pay about 1*s.* 9*d.* to the East India Company more than the sum for which the tea could be brought to market, and which would pay the tax levied on it by the government. This is not the whole amount of the sum paid by the people on this account. The dealers pay the higher price in the first instance, and they must receive on the capital they employ for this purpose proportionate interest. Taking this at only five per cent., that adds another penny to each pound, so that the people pay on account of the monopoly of the East India Company at least 1*s.* 10*d.* more than necessary for every pound of tea drank. At a time when this herb is so largely consumed, this sum is a subject worthy of serious consideration. Not that I would have the people slight their stomachs, and control their desires to injure the India Company, and benefit Mr. Hunt; but I would have them appeal to the *reason* of the legislature, and ask it not to tax them for the benefit of opulent and grasping monopolists.

Yours, &c.

A Lover of Tea.

ADHESION OF NAILS IN TIMBER.

In a former Number (p. 431, Vol. I) we inserted a communication from Mr. Bevan, mentioning generally the results of some experiments which he had made on the adhesion of nails in different sorts of wood. We are happy to have it now in our power to lay before our readers the following more specific details.

Theoretical investigation points out an equality of resistance to the entrance and extraction of a nail, supposing the thickness of it to be invariable; but, as nails generally taper towards their points, the resistance to entrance becomes, of necessity, greater than to that of extraction. In several of my experiments

I have found the ratio to be about as 6 to 5.

The following abstract will exhibit the relative adhesion of nails of various kinds, when forced into dry Christiana deal, at right-angles to the fibres:—

—	Number in the lb.	Inches long.	Inches forced into the wood.	lb. required to extract them.
Fine Sprigs	4560	0·44	0·40	22
Ditto...........	3200	0·53	0·44	37
Threepenny Brads	618	1·25	0·50	58
Cast-iron Nails ..	380	1·00	0·50	72
Fivepenny ditto..	139	2·00	1·50	320
Sixpenny ditto....	73	2·50	1·00	187
Ditto....ditto...	73	2·50	1·50	327
Ditto....ditto...	73	2·50	2·00	530

The last of the sixpenny nails was forced into the wood by the percussion of a cast-iron weight of 6·275 *lb.* falling 12 inches, 4 blows of which were necessary to force the nail 1½ inch into the wood.

It was found that 400 *lb.* steady weight was required to force the same nail to an equal depth.

A sixpenny nail driven one inch into *dry elm*, across the grain, required 327 *lb.* to draw it out, by direct force. The same nail driven one inch *endways* into dry elm, or parallel to the grain, required 257 *lb.* to extract it. The same driven two inches end ways into Christiana deal, was drawn out by the same force of 257 *lb.* To draw out one inch only, under like circumstances, required 87 *lb.*

The relative adhesion, therefore, in the same wood, driven transversely, to that when driven longitudinally, is as 100 to 78, or about 4 to 3 in dry elm; and as 100 to 46, or about 2 to 1, in dry Christiana deal. The relative adhesion, under like circumstances, of elm and deal, proves to be about 2 or 3 to 1.

The progressive depths of a sixpenny nail, driven into a dry Christiana deal by simple pressure, were as follow:—

½ inch, by a pressure of 24 *lb.*
1 ditto 76
1 ditto 235
1½ ditto 400
2 inches..............610

I may observe, that, in the above experiments, great care was taken to apply the weights steadily; and that, towards the conclusion, the additions did not exceed 10 *lb.*, with a moderate interval between each addition. In some instances, the weights were left 10 or 20 minutes, before the load was increased.

In other species of wood, I have found the force required to extract a nail to differ from the above. Thus, to extract a sixpenny nail from a depth of *one* inch out of

Green sycamore, required 312 *lb.*
Dry oak 507
Dry beech 667

A common screw of one-fifth of an inch in diameter has an adhesion about three times as great as that of a sixpenny nail.

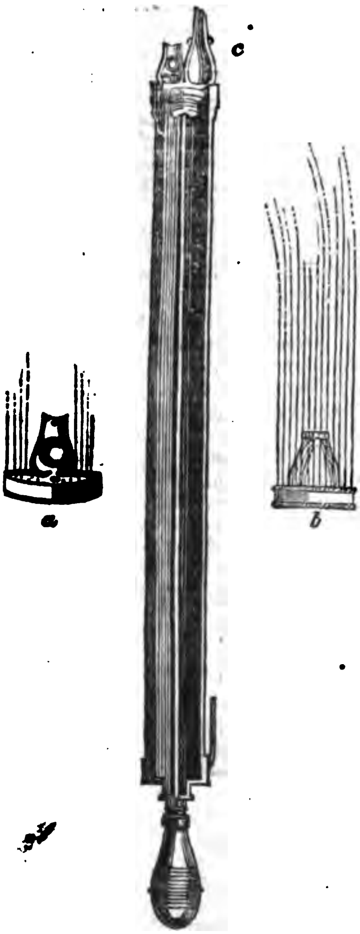
From these experiments, I am able to infer, that a common sixpenny nail, driven two inches into dry oak, would require more than *half a ton* to extract it by steady pressure.

B. Bevan.

IMPROVED SYRINGE FOR WATERING PLANTS, AND FOR EXTINGUISHING FIRES IN HOUSES.

A patent has been obtained by Mr. Read, No. 30, Newington Causeway, and the Horticultural Society have honoured him with their silver medal, for the invention of an Improved Portable Syringe, applicable to the watering of plants and extinguishing of fires. It is made of brass, is about two feet in length, and two inches in diameter, and its extremity is furnished with a screw, which is received into the corresponding screw of a detached perforated cap. Of this cap, there are three different kinds, adapted to the different purposes to which the syringe may be applied, and of which we shall presently speak.

As an horticultural instrument, this syringe is chiefly applicable to the watering of pines, and all plants in conservatories and hot-houses, and for washing or cleansing orange-trees, myrtles, roses, &c. &c. trained to the fronts of houses, particularly from insects (and the larvæ that produce them); both objects it accomplishes with great facility and certainty, without occasioning the slightest injury either to the plants or the fruits, answering not only all the purposes of the barrow engine, but being applicable to confined situations, where the engine could not be used.



The value of this syringe in extinguishing fire, has been demonstrated by positive application. A range of forcing houses belonging to Colonel Austin, of Seven Oaks, was saved by means of it from burning, during the frost in 1822. It will hold about two pints of water, and may be charged and discharged about 16 times in a minute, so that 18 or 20 gallons of water may be thrown to a distance of from thirty to forty feet upon the fire every five minutes. The portability of this hand-engine (as it may be called) gives it this advantage, that it may be brought to act upon the *interior* of a house, or in a single room, as soon as the fire is discovered, and by which it may be often extinguished long before any other means can be brought to bear upon it. It is farther particularly worthy of remark, that the contents of the syringe may be directed upon a room in flames *through the smallest aperture;* and if applied before the flame has obtained an outlet through the roof, will fill the room with a condensing volume of aqueous vapour, *that will contribute to stifle the flames almost as much as the stream of water itself.* In such cases, let the operator continue to be supplied with buckets of water, and he will be either enabled to suppress the fire altogether, or to stop its progress till more powerful assistance can be obtained.

The adjoining engraving will illustrate the construction of this syringe.

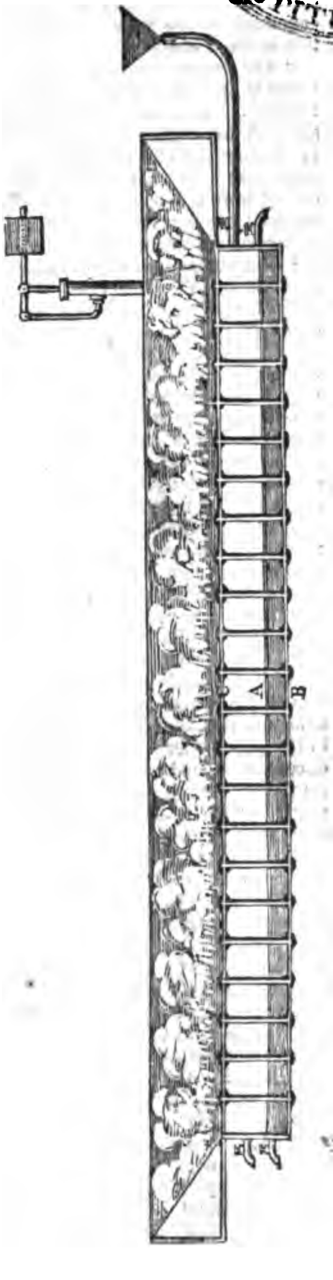
a is the perforated cap used in destroying insects on walls, trees, and plants; *b*, do. for watering plants, in forcing-houses, trees in bloom, &c.; *c*, the cap used in extinguishing fires, receiving the water through a valved aperture, and discharging it in a condensed contracted stream through a short conical tube.

SMITH'S PATENT APPARATUS,

FOR DRYING, BOILING, AND EVAPORATING LIQUIDS BY STEAM.

In our 31st Number, we mentioned the receipt of the description, which we now proceed to give, of a Steam-Boiler, invented by a Mr. Smith, similar in principle to that brought forward by our ingenious correspondent, Mr. Pickering (p. 1, Vol. II), and considered by him (most conscientiously we have no doubt) perfectly original.

"The steam-boiler in this case (as represented in the annexed engraving) is a flat, horizontal vessel, closed on all sides, very shallow in depth, but of such form and extent, in its horizontal dimensions, that the flat, horizontal top of the boiler will form the bottom of the evaporating pan, or vessel, containing the liquor to be heated. The bottom of the boiler is also a flat, horizontal surface; and the space between these two surfaces forms the steam-boiler, which need not exceed a foot in depth for the largest apparatus. This steam-boiler is set in brick-work, over a proper fire-place or furnace; and flues are carried from the fire-place, beneath every part of the flat bottom, so as to give the utmost effect of the fire thereto. A sufficient quantity of pure water is put into the boiler to cover its flat bottom, and fill up about one-third of the depth of the boiler, leaving the other two-thirds of the space for steam, which, as it rises from the water, fills the space between the surface of the water and the flat bottom of the evaporating pan. The steam, being thus applied beneath every part of the bottom, communicates its heat to the liquor contained therein; and being by that means condensed, it descends in drops of water to the bottom of the boiler, and is again raised in steam by the heat of the fire beneath; so that the operation goes on perpetually, without the addition of any more water to fill the boiler. On this system, the steam becomes a medium for conveying the heat, and distributes it uniformly beneath every part of the bottom of the evaporating pan, although the heat is necessarily communicated from the furnace in an unequal manner, being *very intense* immediately over the fire, and *diminishing* in the more distant parts of the flue, till it becomes *very moderate* at the extremity. But, however unequally the fire may thus act beneath the bottom of the steam-



boiler, the effect beneath the bottom of the evaporating pan is perfectly equalized, by the intervention of the thin stratum of steam.

"The steam-boiler is made of thin plates of iron or copper, &c. riveted together. But, to give sufficient strength to its large horizontal surfaces, they are tied together by perpendicular tye-bolts riveted, which extend from the bottom plate to the top plate, and retain the two at an unvarying distance: these tye-bolts are introduced at such distances asunder, as to enable thin metal to resist the utmost pressure of steam ever required for the process to which it is applied. The boiler is provided with a safety-valve, to give vent to the steam, should it ever exceed the intended force. This safety-valve has also the effect of limiting the heat; for, whenever it exceeds the intended degree, the steam will lift the valve, and escape. This rarely happens, as the heat is regularly diffused; and it passes through the bottom of the pan in such a manner as to regulate itself.

"The novelty of this invention (continues the Patentee) consists—

"(1.) In forming a shallow steam-boiler immediately beneath the bottom of the evaporating pan, in such a manner that the steam is condensed in the same boiler in which it is produced; and as both operations are continually going on in the same vessel, it thereby answers the double purpose of *steam-boiler* and *refrigerator*, and requires little or no supply of water after it is once set to work.

"(2.) In the construction of such a shallow steam-boiler of thin plates with flat horizontal surfaces, so tied together by short perpendicular bolts, as to resist the most intense pressure of steam with perfect safety.

"The advantages of this new apparatus are stated to be these—

"First. By the equal diffusion of the heat throughout every part of the liquor, *the utmost effect of the fire is obtained;* for none of the heat is wasted in over-heating particular parts of the liquor, nor are other parts of it left deficient in necessary heat.

"Second. From this circumstance results *a great economy in fuel*, and *a great increase of effect in evaporation*, or boiling, from a pan or vessel of any given size.

"Third. By the load on the safety-valve, *the confinement of the steam*, and consequently *the accumulation of heat*, are limited at pleasure; so that the heat communicated to the liquor can never exceed the intended degree.

"Fourth. It is also of the greatest advantage in boiling worts for brewing, distilling and rectifying spirits, in sugar-boiling and refining, in salt and alum making, and in all other operations where the liquor to be heated is liable to deposit, on the bottom of the boiler, *lees, dregs*, or *other matter*. Such kinds of sediment being always greatest where the heat is most intense, are liable to burn, and form solid incrustations on the bottom of the vessel, to the great detriment and interruption of the operation, as well as to the waste of fuel, and destruction of the boiler. On the new plan these inconveniences are avoided, because the heat is never excessive, and therefore the tendency to deposit is diminished. Burning, or the formation of solid crust is impossible, because the heat is limited.

"Fifth. The method of tying the top and bottom of the boiler together by bolts riveted, affords *a complete security from bursting*, with the advantage of constructing the same of thin plates, and spreading the water in a shallow layer over its bottom; by which means it receives the heat from the fire with more facility than any other kind of steam-boiler; and, for the same reason, the steam communicates its heat to the liquor with greater rapidity than any other form of refrigerator.

"Sixth. The *simplicity* of the apparatus, its *cheapness*, and *durability*, are great and obvious advantages. It is, in fact, the common evaporating pan or vessel, with the addition of a double or false bottom, to receive a shallow layer of water and steam, in the space between them: consequently, its adoption by manufacturers will occasion no change in the external forms of their vessels; nor will it be necessary to make any alteration in the disposition of their present boiling vessels, because the new ones will take but little more room, and will produce very increased effects with less fuel, and less wear and tear."

We are further informed, that this apparatus is already in use at the proprietor's works at Droitwich in Worcestershire, for manufacturing salt from brine, with great advantage. The produce of salt from the pans is about four times as great as from pans of equal dimensions of the ordinary construction, while the salt is of superior quality. The consumption of fuel, by one of the new pans, producing this increased quantity, is even less than by one of the old ones of equal dimensions. The tendency to deposit the sediment called *pan-scratch* is avoided; and *the whole* of the salt contained in the brine is obtained. Great advantages are found to result from forming projecting sides, of about eighteen inches, to the brine-pans; as by this arrangement the edges of the pan are kept cooler than the other parts of it, and the fluid is not only thus prevented from boiling over, but the salt, as it forms, is thrown, by the ebullition, upon the projecting parts; by this means the necessity of raking is precluded. By a constant supply of brine running into the pan, the operation can go on for months without stopping, and consequently considerable labour is avoided.

ANOTHER REMEDY FOR THE CORROSION OF COPPER SHEATHING.

To the Editors of the Mechanic's Magazine.

Gentlemen;—Having read, in a late Number of the Mechanic's Magazine, an interesting account of Sir Humphry Davy's invention respecting Copper Sheathing, I was induced to seek further information on this important subject. In the Encyclopædia Perthensis, I find, under the head of Sheathing, the following observation: "In the Cornish mines, copper or brass pumps are often placed in contact with the vitriolic and other mineral waters with which they abound, and which are known to have a much stronger effect on copper than sea waters. The joinings of these pumps are tarred: one of them was so corroded as to be unfit for use; but the spots of tar, which had accidentally dropped on it, so preserved the parts they covered, that while the surface around was consumed, they actually projected in some places more than a quarter of an inch. The joints, too, were so defended by their thin coating of tar, that they were as perfect as when it came from the hands of the manufacturer. If tar thus defends copper from the acrimonious waters, undoubtedly it would preserve it from the much milder waters of the sea."—Allow me to ask, through the medium of your columns, whether tar would prove as efficacious and as cheap a remedy as the one discovered by Sir H. Davy, and how this property of tar is to be accounted for?

Philotechnus.

POWER OF STEAM-ENGINES.

April 19, 1824.

Gentlemen;—As the erroneous methods used by your correspondents, p. 229, Vol. I, and William Andrews, p. 90, Vol. II, for finding the effective power of steam-engines, may lead the inexperienced into egregious errors, I think the sooner the latter are cautioned against adopting the plans of the above persons the better. The first makes his engine with the cylinder, 28 inches diameter, more powerful than seventy-three horses, and the latter makes the same engine equal to 48½ horses; whereas it is well known to every engineer, that an engine to do the work of only forty horses, must have a piston thirty inches diameter moving over 200 feet per minute; and an engine with a piston 16 inches diameter, moving at the same rate, is considered equal to 8 horses only. I shall, perhaps, in a short time, forward you a method for finding the power of steam-engines, which, I trust, will be found as correct as the nature of the thing will admit.—Your humble servant,

S. Y., *a Young Engineer.*

TABLE OF CANDLE-LIGHT:

For Mean Time for the second Quarter of 1824.

BY B. BEVAN, ESQ.

(Continued from p. 316, Vol. I.)

DAY.	APRIL.		MAY.		JUNE.	
	End, Morning.	Begin, Evening.	End, Morning.	Begin, Evening.	End, Morning.	Begin, Evening.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	5.. 6	7.. 2	3..58	7..56	3.. 7	8..47
2	5.. 4	7.. 4	3..57	7..57	3.. 6	8..48
3	5.. 1	7.. 5	3..55	7..59	3.. 6	8..50
4	4..59	7.. 7	3..52	8.. 2	3.. 6	8..50
5	4..57	7.. 9	3..50	8.. 3	3.. 5	8..51
6	4..54	7..11	3..48	8.. 4	3.. 3	8..53
7	4..51	7..13	3..46	8.. 6	3.. 2	8..54
8	4..49	7..15	3..44	8.. 8	3.. 2	8..55
9	4..48	7..16	3..42	8..10	3.. 2	8..56
10	4..45	7..17	3..40	8..12	3.. 1	8..57
11	4..43	7..19	3..39	8..13	3.. 1	8..57
12	4..41	7..21	3..37	8..15	3.. 0	8..58
13	4..39	7..23	3..36	8..16	2..59	8..59
14	4..36	7..24	3..34	8..18	2..59	9.. 1
15	4..34	7..26	3..33	8..19	2..59	9.. 1
16	4..31	7..29	3..30	8..22	2..59	9.. 2
17	4..29	7..31	3..29	8..23	2..59	9.. 2
18	4..26	7..22	3..27	8..25	2..58	9.. 3
19	4..24	7..34	3..25	8..26	2..58	9.. 4
20	4..22	7..36	3..24	8..28	2..58	9.. 4
21	4..21	7..37	3..23	8..29	2..58	9.. 4
22	4..18	7..38	3..20	8..31	2..58	9.. 4
23	4..15	7..41	3..19	8..33	3.. 0	9.. 4
24	4..13	7..43	3..18	8..34	3.. 0	9.. 4
25	4..11	7..45	3..16	8..36	3.. 0	9.. 4
26	4.. 9	7..47	3..15	8..38	3.. 0	9.. 4
27	4.. 7	7..48	3..14	8..39	3.. 1	9.. 4
28	4.. 4	7..50	3..12	8..42	3.. 2	9.. 4
29	4.. 2	7..52	3..11	8..43	3.. 2	9.. 4
30	4.. 0	7..54	3.. 9	8..45	3.. 3	9.. 3
31	——	——	3.. 8	8..46	——	——

CHINESE PAINTS.

We have been favoured by an intelligent correspondent with the following particulars of the method of preparing Chinese Paints, which he thinks may throw some light on the secret mentioned at p. 108, Vol. I, and at page 32, Vol. II.

The peculiar beauty of the Chinese drawings is owing, not to the particular nature of the colouring substances, but merely to their preparation, and to their being mixed with *glue* or *size*, instead of *gum-water*, as is the common practice in Europe.

In regard to the preparation, two things must be observed; first, that the beauty of the colour depends, in a very great measure, upon the fineness of its particles, the finest being always the most beautiful. A Chinese painter often employs a man for three or four days to grind a small quantity of vermillion in a porcelain mortar, and it is from this they derive their fine reds. It is, therefore, necessary to levigate the paints to a very great degree of subtility, in order to let them acquire the *utmost degree of beauty* of which they are capable; and it must not be imagined, that because they seem to be exceedingly fine to the touch, they may not be improved by further grinding.

Secondly, it must be considered, that most mineral colours are prepared with acids, alkalies, or other salts, and that a small superabundance of those saline substances generally remains with them, which, after a shorter or longer time, produces considerable alteration in their brilliancy, and often entirely changes the colour.

In order to obviate this inconvenience, the paint, after having been levigated, must be repeatedly washed in clean water: distilled water is the fittest; but the waters of many springs are sufficiently pure for this purpose. In order to effect this properly, put about half an ounce of the paint in a half-pint glass phial, and fill the rest of the phial almost entirely with water; shake it well; then let it stand for a while, and the coloured powder will soon fall to the bottom; then pour off the water, by inclining the phial gently, so as not to disturb the sediment, and fill it again with clean water, and so on for five or six times; after which, the colour being gently dried, must be ground a little longer, and then it is fit for use.

The glue or size to be mixed with the paints, is extracted from parchment in the following manner:—Take about four ounces of clean parchment, cut it into small bits, and put it to soak in a quart of clean water for about twelve hours; then boil the whole on a gentle fire, and in the beginning take off the scum with a spoon. The vessel must remain always uncovered, and the liquor must be stirred now and then. After boiling for about an hour, take off the pot from the fire, and strain the liquor, whilst hot, through a coarse sieve. The liquor must be put into a clean pot again over the fire, and boiled gently till half of it is evaporated; the remainder is then spread very thinly upon panes of glass, which being kept in a warm place for a day or two, the size will be dried, and will become very hard.

When it is wanted for use, put a small quantity of it in a cup of lukewarm water, and dip the hair-pencil in it.

The properties of this glue, which render it much superior to gum-water, are the following: *it does not deaden, nor otherwise alter the colours* with which it is mixed. *It does not crack like gum;* and it becomes soon so hard, *as not only to defend* the colours from being affected by smoke and other vapours, but even to bear the surface of the drawing being cleansed by means of wet sponge.

WM. GALWARD.

Reading.

ENORMOUS SHIPS OF THE EGYPTIANS.

The Ptolemies kept up a formidable marine in the Red Sea and Mediterranean to protect the Egyptian merchants. Theocritus affirms they had 97 first-rate ships, several of which were 200 feet long, besides a multitude of small vessels, and 4,000 barks to bear orders throughout the empire.—*Savary's Letters on Egypt, vol. 2.*

Under his reign (4th Ptolemy) were built vessels of so enormous a size, that they have never since been equalled. Plutarch describes one of his vessels with 40 benches of rowers, 373 feet long, and 64 high at the poop. This enormous ship, beside which our three-deckers would seem small frigates, contained 400 sailors to work her, 4,000 rowers, and about 3000 fighting men. —*Ib.*

The ship built by Ptolemus Philopater was 280 cubits long, 38 broad, and 48 high; it had 400 benches of rowers, which were in number 4,000, and the decks would contain 3,000 soldiers, &c

The ship or galleon of King Hiero, that famous work of Archimedes, had ten stables for horses, eight towers with walls, besides fish-ponds, mills, gardens; in short, it was like a fortress, and many fair rooms paved with agate and precious stones, &c.—*Palairet's short Treatise on Arts and Sciences, French and English.*

SPORTSMAN'S VADE-MECUM.

We have seen Mr. Linnie's new invention. It is a curious piece of mechanism, comprising a complete fowling-piece, barrel 23 inches long, calibre ⅝ inches, detonating lock, butt with proper angle, ramrod, &c. &c.; a complete fishing-rod about 12 feet long, dog-call, looking-glass, and snuff-box, with pen, in the small compass of an ordinary-sized walking stick, weighing about 3½ lbs. When used as a fowling-piece, it contains a flask with powder and shot sufficient for 12 or 14 charges, and can be used as a walking-stick or fishing-rod, loaded and primed with the greatest safety. Its portability is such that it can be transformed and re-transformed to all its purposes, including loading, priming, and firing, in the short space of three minutes. Mr. Linnie is a native of Kirkwall, in Orkney, and is now on his way to Edinburgh and London, for the purpose of laying his invention before the Societies for the Encouragement of Arts. —*Inverness Courier.*

CHANGE OF THE SEAT OF COLD DURING FROST.

It is both clearly proved, and philosophically accounted for, that air is warmer close to the earth than at some distance above it, and we consequently find lofty mountains, even in warm climates, constantly crowned with snow. During a frost, however, things appear to be reversed. The experiment has been often made, and we take the most concise account, which is an observation made one winter in Hampshire. Mr. White placed a thermometer on the top of a hill in Silborne, and another in the valley, towards evening, of a very cold night. During the night, that in the valley went down to one degree below zero, that is, 33 degrees below the freezing point; whereas that on the hill, 200 feet at least higher, fell only to 17 or 15 degrees lower than the freezing point. On the following morning, that in the vale was at 20, while the elevated thermometer was at 22: so that the difference of cold between the two situations was once eighteen degrees less above that below, and through the whole frost continued ten or twelve. This variation in temperature was confirmed by the total destruction of the forest evergreens in the valley, those on the hill remaining unhurt.

QUICK COOKERY.

We have seen within these two or three days a machine invented by Mr. Joseph Harmer, the great value of which consists in the facility by which all different articles of food requiring culinary preparation, may be rapidly—almost instantaneously, prepared in the course of a minute or two. The mechanism is simple, yet philosophical; a few drops of spirits, or of alcohol—scarcely a cent of expence—is sufficient to put the whole in operation, and beef steaks, mutton chops, veal cutlets, eggs, ham, and venison, may be got up adapted to the most epicurean appetite.—*Richmond* (U. S.) *Phœnix.*

INTRODUCTION OF SILK INTO EUROPE.

Silk was long an indispensable appendage of luxury to Europeans before the manufacture of it was introduced amongst them. Immense sums were annually sent out of the Roman empire to the farthest parts of the then known world, for the purchase of a foreign manufacture, which employed no citizen or tributary subject; and a great part of the profits arising from so lucrative a commerce fell into the hands of the Persians, the inveterate enemies of Constantinople. In whatever manner, indeed, the traffic had been carried on, so copious an importation of so expensive an article from so vast a distance, must have tended to impoverish the empire. The emperor Justinian had long desired to turn this lucrative commerce into a Roman channel; but insuperable obstacles prevented the execution of his design. Those difficulties, however, which all the policy of the emperor could not remove, were surmounted by the enterprising sagacity of two Persian monks, who, in the quality of missionaries, had long resided in China. Amidst their religious occupations, they had viewed, with an investigating eye, the manufactures of silk in that country, the myriads of silk-worms, and the mode of their treatment. They discovered that the importation of so delicate and short-lived an insect, from so great a distance, was impracticable; but they imagined that in the eggs a numerous progeny might be preserved and propagated. Knowing how agreeable the undertaking would be to the imperial court at Constantinople, they arrived, after a long journey, at that metropolis of the Roman empire; and having imparted their project to the emperor, were, by the liberality of his gifts, and the splendor of his promises, encouraged to carry it into execution.

The two monks having travelled back to China, and by concealing the eggs of the silk-worm in a hollow cane, deceived a people, ever jealous of its commerce, returned in triumph to Constantinople, with the spoils of the East, having made a greater conquest than either Justinian or his celebrated general, Belisarius, had ever achieved. Under their direction the eggs were hatched by artificial heat; the worms were fed with leaves of the mulberry-tree; they lived and laboured, and, by the use of proper means, the race was propagated and multiplied. Experience and reflection soon correct the errors incidental to a novel attempt; and in a short time the subjects of Justinian equalled the Chinese in the management of the insects and the manufacture of silk. From Constantinople this valuable insect has been gradually introduced into all the southern parts of Europe; and the material produced by it is now manufactured in almost every country in this quarter of the globe. Thus, in consequence of a singular circumstance in the history of commerce, of which the epoch is assigned to A. D. 552, modern Europe enjoys, at an easy expense, one of the most costly luxuries of the ancients which was formerly peculiar to China, and once sold at Rome "FOR ITS WEIGHT IN GOLD."

BLEACHING SUGAR.

It is announced in a French Journal, that *chlorate of lime*, which is now so extensively employed in bleaching linen, may also be successfully applied, both in its gaseous and liquid state, to bleaching sugar. As the gas is formed, it is conveyed into a solution of sugar previously filtered, and its absorption is promoted by agitating the sugar. When the colour which is required is obtained, the liquor is filtered over lime to separate the muriatic acid, and then over a preparation of animal carbon. Immediately after the filtration, the syrup is concentrated by the usual method. The gas may also be applied to sugar already crystalized, by spreading it over shelves, made altogether of wood, or of hair cloth, and placed round an apartment, into which the gas is conveyed as it is produced. The sugar is spread out on very thin layers, and is sometimes stirred by means of rakes. The sugar must afterwards be exposed to the action of lime to separate the excess of muriatic acid. The liquid chlorate may also be employed, by adding it to the filtered syrup, in the proportion of one-fifth, and agitating the mixture, then boiling it with animal carbon, filtering, and again agitating with another dose of chlorate, amounting to the sixth part of the whole. These operations are again repeated with the chlorate, in the proportion of a tenth part, and the syrup is finally filtered, and it passes clear and transparent like water. In the second mode of application, the animal charcoal is first added, and then the chlorate, after which the same agitation and filtering, as above described, is again to take place. The chlorate may also be employed to bleach molasses, so that it may be used on several occasions, when it is now rejected in consequence of its colour. The author gives no estimate of the advantages of employing the chlorate of lime, and, therefore, we are quite unable to say whether his method is an improvement or only a novelty.—*Chemist.*

A NEVER YIELDING CEMENT.

Pound calcined oyster-shells, sift the powder through a silk sieve, and grind it on a porphyry slab, till reduced to the finest powder; then take the *whites* of several eggs, according to the quantity of the powder, beat them well, and having mixed them with the powder, form the whole into a kind of paste: with this paste join the pieces of china or glass, and press them together for seven or eight minutes, and the united parts will stand heat and water, and will not come apart if they should fall on the ground.

NEW PATENTS.

To John Arrowsmith, of Air-street, Piccadilly, who, in consequence of discoveries by himself, and communications made to him by certain foreigners residing abroad, is in possession of an improved mode of publicly exhibiting pictures or painted scenery of every description, which he denominates Diorama. — 11th February, 1824 — six months.

To Abraham Henry Chambers, of New Bond-street, esq.; for improvements in preparing and paving Horse and Carriage-ways.—Dated Feb. 28, 1824.—six months.

To John Gunby, of New Kent Road, Sword and Gun-manufacturer; for a process, by which a certain material is prepared, and rendered a suitable Substitute for Leather.—Dated Feb. 28, 1824.—six months.

To John Christie, of Mark Lane, London, merchant; and Thomas Harper, of Tamworth, merchant; for an improved method of combining and applying certain kinds of Fuel.—Dated Feb. 28, 1824.—six months.

To William Yetts, Great Yarmouth, merchant and ship-owner; for a certain Apparatus to be applied to a Windlass.—Dated Feb. 28, 1824.—two months.

To James Wright Richards, of Caroline-street, Birmingham, Metallic Hot-house-maker; for an improved Metallic Frame and Lap, applicable to all hot-houses, green-houses, horticultural frames, and glasses, sky-lights, and other inclined lights and glasses.—Dated Feb. 28, 1824.—six months.

To William Greaves, of Sheffield, merchant; for a certain improvement on or additions to harness, principally applicable to carriages drawn by one horse.—Dated Feb. 28, 1824—two months.

To William Jones, of the city of Westminster, land agent and engineer; for a certain improvement in the construction of Rail and Tram-Roads or Ways; which rail or tram-ways or roads are applicable to other useful purposes.—Dated Feb. 28, 1824.—six months.

TO CORRESPONDENTS.

The laudable objects of the "Association for Improving the Condition of the Poor" shall receive a notice in our next.

"A Friend to the cheap Diffusion of Knowledge" is under a mistake in stating that we have taken "no notice whatsoever in the Mechanic's Magazine" of Professor Millington's Lectures at the Mechanic's Institution. We refer him to p. 434, Vol. I, where a pretty full abstract is given of the Professor's first lecture. A regular continuation of reports was not promised; and there are reasons against such a course of proceeding too obvious we trust to require stating.

We have seen the attack pointed out to our notice by "A Friend and Committeeman;" but to volunteer a formal refutation of it in our pages, might seem to some folks only an indiscreet way of giving general circulation to charges which those most concerned do not consider deserving of notice. Any thing, however, that the managers may be officially desirous of having published on the subject, we shall very readily insert.

"An Apprentice" ascribes very wrong motives. We cannot accomplish every thing at once.

The answers to problem 5 in our next.

H. I. on the advantages of going to France, should state *facts*. He need not be told that there is a *cant* in finding fault as well as in other things.

We have no desire to trespass on the patience of "Henricus," but must use our own discretion as to the order in which articles are inserted.

W. H. B.—I. Reywob—and W. A. D. are intended for insertion.

A Subscriber is informed, that the delay which he regrets, may be remedied by ordering the parts to be forwarded from town as soon as published, which in most cases may be easily done.

Another subscriber who complains of not being able to obtain the Supplementary Number, will find, on application to our Publishers, that there has been a misapprehension in the case.

Communications received from R. B.—Nauticus—Dixon Vallance—Edward—J. V. H.—W. Potter—X. Y. Z. (Birmingham)—Mr. Wynn—H. S.—R. O. N. M.—A Bachelor—Edward Jameson—W. H.—A Constant Reader—Observator—Omega—R. Clark—T. W. Shaw—A Young Mechanic—George Lovatt—M. F.—F. W. C—o—e.—H. Cock Shotsman—I. H. (Hawarden)—Rev. M. Hayes—Rob. M'Voy—Sarah—J. M.

Communications (post paid) to be addressed to the Editors, at the Publishers.

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Museum, Register, Journal, & Gazette.

It is a pleasure to stand upon the shore and to see ships tossed upon the sea; a pleasure to stand in the window of a castle and to see a battle; but no pleasure is comparable to the standing upon the 'vantage ground of truth (a hill not to be commanded, and where the air is always clear and serene), and to see the errors, and wanderings, and mists, and tempests in the vale below.—*Bacon*

No. 36.] SATURDAY, MAY 1, 1824. [Price 3d.

Fig. 1.

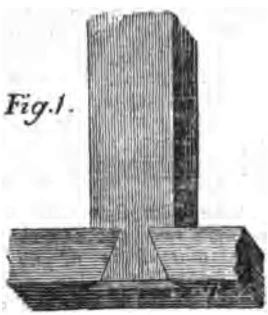
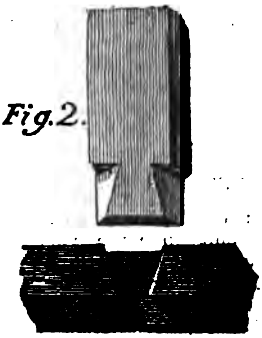


Fig. 2.



DOVE-TAIL JOINT.

We give the above name to a very ingenious and neat manner of joining, specimens of which have been sent us by a most intelligent mechanic, who describes it as not much known. Fig. 1 represents the joint as fitted, and fig. 2 as taken asunder. The socket in the latter is inverted, for the better display of its form. The socket is made thus: upon the entering side a gage-draught is run at three-fourths the depth, and upon the opposite side at one-fourth, which determines the bottom of the socket. Then for the sides, the whole breadth of the tenon is set off upon both gage-draughts, and narrowed at both sides of the surface by the depth at each extremity. The sides are then cut with a saw, and the socket chipped out, the bottom of which is a parallelogram, and the bevel of all the parts equal. The same measures are taken upon the tenon, and the whole of it is cut by the saw. The principal advantages of this joint are these: 1, it can be fitted much more nicely and expeditiously than the mortice and tenon; 2, the tenon is strongest at the neck where most strength is required; 3, against a direct pull it acts as a dove-tail; and 4 (though perhaps a matter of no great importance), it looks very handsome.

THE MECHANICAL PUZZLE.

Since the insertion of the article under this title (p. 329, Vol. I), and the explanation given by Jackson (p. 364), we have received several other communications respecting it, which have led to a result that well deserves to be laid before our readers. One very intelligent correspondent, J. Y., after describing how a puzzle of this sort could be made, was pleased to add—" But the taking it to pieces after it is thus formed is a mere quibble, for it is effected in this manner: one of the knobs screws off, and by an expert tradesman this may be done so as to deceive the most inquisitive scrutineer." Another (J. G.) observed, that he had been positively assured by the gentleman who first showed him a puzzle of this sort, and who knew all about it, that it was not to be taken asunder "by *force*," in the way described by Jackson. Now, we have the best of all possible evidence before us, for saying that both these gentlemen are in the wrong, and Jackson as nearly in the right as circumstances would allow him to be: there is no *quibble* in the matter, and it is "by force" the thing is accomplished. A correspondent who writes to us under the designation of "A Cotton Spinner," and dates his letter from "North Wales," was so kind as to transmit to us a very neat model of the puzzle, with an iron mould, and block, made to fit the knobs, by means of which, and the help of a vice, he assured us that they could be compressed at pleasure to the degree required, after which a short immersion in warm water would restore them to their original size. We immediately placed these in the hands of Mr. John Johnson, smith, one of the managers of the Mechanic's Institution, requesting that he would make the necessary experiments, to place the matter beyond doubt, and the following is the report which he has made to us:—

"The Mechanical Puzzle sent from North Wales, which you did me the honour to place in my hands in the lecture-room on Friday evening, to try the experiment on, is similar to the engraving (page 329, Vol. I). The circular piece, containing the mortice, is of box-wood, and the four keys of mahogany. It was some hours before I could make up my mind to try the experiment, it appearing to me and my fellow workmen impossible but that the knob would be crushed to pieces. I would say in future, however, to the sceptic, only believe—all things are possible. The experiment was made in the factory of Mr. Bull, ironmonger, &c. 63, Blackman-street, Borough. I placed one of the wooden keys in the iron mould, laying the iron block thereon. I then carefully screwed it up in the vice; and to the astonishment of all, I compressed one end of the key to one-half of its original dimensions, and took it out, which gave room to pass the other three through the mortice! Numbers saw it when compressed, but no one could believe that it would expand to its original form again. I put it, however, in warm water, and in a short time it assumed the same form and size as the three other pieces, and all were then equally impassable through the mortice.*

"In order that your numerous readers may not say the puzzle, like others, is of no use, I will describe a few advantages which it occurs to me may be derived from it. Hammers, choppers, and numberless other tools may have their wooden handles thus immoveably fixed, and the accidents which are frequently occasioned by their separating, be prevented. Let the hole or mortice be made of a tapering form; compress the end of the handle so as to pass the small entrance; then soak it in water, and it will expand so as to be fixed in the mortice beyond the power of removal. Were the same process followed in the making of chairs and other articles, they would never come to pieces, although not glued; neither damp nor water could separate them. Flooring boards also may be thus made with good close joints, although the wood has not been seasoned or dryed; and in ship-building the applications of this method could not fail to be of the greatest importance. Compressed wood may likewise be usefully employed by the miner and quarry-

* We saw it ourselves in both states, and can vouch for the perfect accuracy of Mr. Johnson's statement.—*Edit.*

man instead of gun-powder, and save many lives. Let the rock, for example, be bored the same as for gun-powder; then compress a chosen wood as much as possible in iron moulds, drive it in the holes, then place very long tubes of water on the ends of each wedge; the water will act by hydrostatic pressure on the wood-wedges, and cause them to expand, and rend the mass of stone from the rest as effectually as gun-powder.* The principle may be applied in numerous other ways, but let those for the present suffice.

"J. JOHNSON."

BOAT WITH TWO HULLS.

Ipswich, Feb. 28, 1824.

GENTLEMEN;—The remark made in the Mechanic's Magazine, that we should endeavour to increase our knowledge by mutual communication, induces me to send you a description of a boat constructed by a gentleman in this town, which may be made to answer the purpose of a life-boat. It consists of two hulls or boats, placed alongside each other, at a sufficient distance to admit the rowers, steersman, and passengers, between them, who sit upon benches, with their feet resting on a grating placed at a sufficient height above the water to keep them dry. Each hull is provided with a keel, and decked over. The general appearance of the structure, is that of a Norway yawl. The idea, I believe, is not entirely original. The ice-boat at Hamburgh mentioned in your 10th No. is something like it; and some years since a person obtained a patent for a vessel with two hulls, which were connected together by beams, and had two rudders: in this case there is but one rudder. The vessel draws but little water; and from having two keels, she sits upright when aground.—Yours truly,

NAUTICUS.

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* See a most complete example of this application of the principle under the head of "Extraordinary Explosive Force of Moisture," p. 134, Vol. I.

MR. PICKERING, IN VINDICATION OF HIS STEAM-ENGINE BOILER.

To the Editors of the Mechanic's Magazine.

Plaskynaston, April 17, 1824.

GENTLEMEN;—Should my method of constructing high-pressure steam-boilers prove as effective as I flatter myself it will be found, it is a little unfortunate I did not communicate my plan to the public six months ago, as it seems the claim of prior invention by Mr. Smith, and the patent in contemplation mentioned by Mr. Fowler in the 31st Number of your Magazine, may, perhaps, if substantiated, shut it out for a long while from general use.

That every man has a right to the reward of his inventive labours according to their merit and utility, no one will, I presume, attempt to deny; and far be it from me to wish to lessen whatever credit may strictly belong on such grounds to either Mr. Smith or Messrs. Furnival and Co.; but it is a justice I owe myself to state, I never heard nor saw any thing relative to the invention of the former, till I noticed Mr. Fowler's letter before alluded to. I never made a secret of my plan, and, if necessary, it were easy for me to prove that I openly exhibited a drawing of the boiler in question, and frequently mentioned the subject in the circle of my friends many months previous to the time stated by Mr. Fowler; but, be this as it may, I looked to no remuneration; for my principal motive for endeavouring to turn the public attention to such matters was a desire to restore confidence in high-pressure boilers, that steam navigation might be brought to perfection. If this grand end could be attained, it would be of little consequence to me by what means, or by whom it might be effected.

It is a source of much gratification to me to learn, that others who have no doubt given the subject much serious consideration, have drawn the same conclusions, and entertain the same opinions as myself, and I shall sincerely rejoice at the success of their efforts. I observe, with much pleasure, the rapid march of chemical and mechanical knowledge, and am often tempted to exclaim with the good old philosopher of Wigfair, now no more, "O that I had not been born for five hundred years to come!" Such pleasing anticipations had he of future improvement, that he seemed to regret leaving life solely because each successive day produced something new in science, of which death would prevent the enjoyment. But to return to my subject,—I own I cannot conceive how a boiler constructed on my plan can be rendered effective for salt-making, unless the *principle of a flat shape* is what is alluded to, which certainly is every way eligible; but unfortunately both for Mr. Smith and myself, I fear we must abandon our fancied claims to originality on that head; as, on showing my safety-boiler to an intelligent friend a few days ago, he laughingly informed me there was nothing new in the *flat principle*, for that more than twenty years ago, when lying in camp, he had been in the constant habit of using a tea-kettle so formed, which was called a *conjurer*, as by merely burning a sheet of brown paper under it, a quantity of boiling water was produced, sufficient to make tea or coffee for one or two persons. Probably there may be still many of these conjurers in existence, if not, the hint may be worth something to military men. The improvement (I may surely be allowed to use so modest a term) which I lay claim to, if it deservers notice, is the mode of constructing a flat-shaped boiler, with rivet bolts *through* it, by which means it is rendered perfectly secure, and capable of resisting the utmost efforts of highly rarefied steam; as without such precaution, a *flat* boiler, made of the strongest iron plates, would, by its action, be immediately inflated like a balloon, and burst.

If Mr. Smith's method of preventing this expansion, is superior, equal to, or in any way resembling mine, I cheerfully resign to him the right of priority. The drawing of his salt-pan, with which you are about to favour us, will throw some light on this subject,* and the *specification* of the *announced* patent, when published, will, as far as such vague matters generally go, enable scientific men to judge to whom the merit of effective invention in this case belongs. I have no wish that my play-thing should come in the way of his more serious views of emolument; if I jostle him or others a little in the present narrow path of mechanical emulation, it shall be with good-humour on my part; I hope every succeeding year will see that path widened and improved, and so M'Adamized, that the footsteps of Time himself shall produce no impression. But without meaning in the slightest degree to point my remarks at Mr. Smith or his friends, I beg leave to say that these perpetual announcements of new patent inventions, by one or other, which inventions may in reality be little more than the floating visions of a mechanical mind, will, I fear, tend greatly to prevent your Magazine becoming so universal a register and repository as I sincerely wish to see it, of the numberless valuable, though perhaps fleeting inventions, which have at times a transitory possession of the mind of every mechanical man, and which are often totally lost in consequence of death or forgetfulness.

Were a few of our first-rate mechanics who have leisure, to set the example of occasionally letting these *lucky thoughts* appear in your pages, I have little doubt but it would soon be followed by a large portion of your readers with increasing satisfaction; but the idea that there is always some *announced* patent invention of widely extended *principle*, the skeleton of which may perhaps be filled up by an appropriation of any of the

* See our last Number.

hints or suggestions above alluded to, that may suit the purpose, will check the current of such liberal communications for the public good, and be sufficient to deter any person from supplying them; as no one would like to submit to a pilferage of this kind, which it is evident may be carried on almost with impunity, by any one mean enough to descend to such unhandsome practices.

I remain, Gentlemen,
Your humble servant,
E. Pickering, Jun.

SQUARING THE CIRCLE.

Gentlemen;—In your 21st Number I read a paper sent you by "A Practical Mechanic," claiming the discovery of that famous problem, the Squaring of the Circle; and, subsequently, the very distinct refutations of Mr. Bevan (p. 344, Vol. I), and Mesurage (p. 55, Vol. II). Nothing more can be wanted to show, mathematically, the absurdity of the "Practical Mechanic's" notion on the subject; but it may, perhaps, serve to confirm his cure from a very pernicious delusion to know, farther, that his is not the only wise head which has vexed itself with this paradox to no purpose. The trisection of an angle, the doubling of the cube, the squaring of the circle, and the existing relation between the side of a square and its diagonal, have all been insurmountable obstacles to the geometrician. When the plague raged at Athens, the Oracle was consulted about the time of its duration, when it gave for answer, that the plague would cease when the Temple of Apollo, which was cubical, should be doubled. At first, nothing was thought more simple; but upon trial, it *baffled the most celebrated geometricians of Greece*. Van Ceulen *attempted* what our practical mechanic has *discovered*, by extending the decimal part of the ratio between the diameter of a circle and its circumference (which is the first step towards a discovery) to an amazing length, but at last gave the task up in despair, ordering however that the work (like Archimedes, with his sphere and cylinder) should be engraven on his tomb!

Mr. Professor Leslie, in his Elements of Geometry, and if I mistake not, in his work on *Curve Lines*, has given an analytical view of the trisection of an angle; and Euclid, in his Eleventh Book, has briefly stated a method for doubling the cube; but the squaring of the circle, and the ratio between the side and diagonal of a square, will NEVER *be discovered*, the parts being incommensurable; although any school-boy or Practical Mechanic may do either *practically*.—Thus,

$\sqrt[2]{1 \times 3{\cdot}1416 \times {\cdot}25}$ = the side of the square of the circle.

$\sqrt[3]{1728 \times 2}$ = the side of the double of the cube.

$\frac{30^\circ}{3}$ = the trisection of an angle.

Let the side of the square be 4; then $\sqrt{4^2 \times 2} = 5{\cdot}65+$; that is, the relation will be as 4 is to $5{\cdot}65+$.

Now, all this is done without either turning lathes, jack-planes, or drawing awls. But will any person tell me that the operation is mathematically true? I conclude with the words of Lord Bacon—"Expert men," says he, "can execute and judge of particulars, one by one; but the general counsels, and the plots, and the marshalling of affairs, come best from those that are learned." J. Y.

RULES FOR FORMING, COMPUTING, AND SUB-DIVIDING ANGLES.

[*Extracted from Mr. Phillips' Treatise on the Use of Mathematical Instruments.*]

I.—To make angles of any proposed number of degrees.

Rule.—Take transversely the chord of 60 degrees, at any convenient opening of the sector, and describe an arc; then take the transverse distance of the proposed number of degrees, and place both points of your compasses upon the arc; draw lines from the centre through the two said points, which will form the angle required.

II.—To find how many degrees are contained in any angle.

Rule.—With the chord of 60 degrees, taken as directed in the last Rule, and one foot of your compasses upon the angular-point, describe an arc from one line to the other; then take the length of this arc in your compasses, and apply it transversely upon corresponding divisions, which will show how many degrees are contained in the angle.

Note.—In this and the preceding rule, the scale of chords is used.

III.—How to take off any number of degrees from the line of tangets.

Rule.—1st. When the proposed number is less than 45 degrees, open your sector to any convenient radius; place one foot of your compasses upon that division on the large radius, which denotes the number of degrees proposed; and the other foot upon the same division on the other leg of the sector, and it will be done.

2nd. When the given number exceeds 45 degrees, place your compasses on the less radius, and proceed as before. CANTAB.

NATURE AND PROPERTIES OF CONCRETE NUMBERS.

Numbers are either abstract or concrete. When a number stands alone it is abstract, as 5, 9, 47, &c.; when the name of something is joined to it, it is called concrete: thus, 5 yards, £50, 24 horses, &c. An endless variety of changes can be produced on abstract numbers, but concrete numbers must be managed under certain restrictions.

I. Two concrete numbers can neither be added nor subtracted, unless a unit in the one be of the same kind and value as a unit in the other. For instance, 4 apples and 3 plums would neither make 7 apples nor 7 plums, nor 7 units of any assignable kind whatever; and it is impossible to take 5 gallons wine measure from £20 sterling, and state the difference.

It is also obvious, that if one number be abstract and another concrete, they can neither be added nor subtracted.

II. To multiply a number is to increase it by adding to it numbers equal to itself. The multiplier is an abstract number, expressing merely the number of additions. The product is a concrete number of the same kind as the multiplicand.

III. Division is a continued subtraction of one number from another, till that other is exhausted. The quotient, which expresses merely the number of times the subtraction has taken place, is an abstract number. The divisor is a concrete number of the same kind as the dividend.

It is obvious from principle I. that a concrete number cannot be divided but by a concrete number of the same kind.

When division is performed for the purpose of separating a number into a given number of equal parts, the number of those parts is made to represent the value of one of them, and employed as a divisor, and the quotient, which really expresses the number of parts, is thus made to represent the value of the part sought.

The only exception to these remarks is in the case of measures of extension. Any measure of length may be multiplied by any other measure of length, and the product will be different in kind from either multiplier or multiplicand. If the units in the two factors be the same, the product will be square surfaces, having a side equal to a unit in either of the factors. But if the lineal measuring units in the two factors be different, the product will be rectangular surfaces, each having its length equal to the larger unit, and its breadth equal to the smaller. Those surfaces admit of being still farther multiplied by measures of length, and the product is a quantity different in kind from both factors. If the three factors thus multiplied together are in the same denomination, the product is cubes, having for their side a unit of that denomination. If the factors are of different denominations, the product is rectangular prisms, each having for its length a unit of the highest denomination, for its breadth a unit of the next, and for its thickness a unit of the lowest denomination. This last product cannot be farther multiplied, unless by abstract numbers; but it may be divided by a measure of length, and the quotient will be the surface, or by superficial measure, and the quotient will be a line, or by a measure of solid content, and the quotient will be an abstract number.

F. W. J.

Dundee, March 17, 1824.

WATER TELESCOPE.

We have been favoured with an account of a new optical instrument of very considerable ingenuity, invented by a Mr. William Leslie, of Lausinburgh, United States, for seeing through water, and thus exploring the bottom of rivers, &c. It consists of a tube that may be varied in length as occasion shall require, about an inch broad at the top, where the eye is applied, and regularly enlarging to the bottom, which bears a proportion to the other end, about 10 to 1 in diameter. Each end is glazed. The great reason why one cannot look through water to the bottom, is the reflection and refraction of the rays of light upon arriving at the surface. This glass overcomes that difficulty, by extending the eye, as it were, into the denser medium, and making use of the light which is in the water, where the rays pursue right lines, as well as in the rarer medium of the air. For use in the night, it is fitted with lamps suspended near the bottom in a shorter cylinder, which goes on over the top of the tube and descends till the bottom of the cylinder is as low as the bottom of the tube, and there it is secured. In the space between the cylinder and tube, lamps are suspended; the mouth of the cylinder, as well as the tube, being glazed. To let off the smoke of the lamps, and supply them with air, two small pipes, the first from the top, and the second from the bottom of the cylinder, lead up the side of the tube. The lamps throw a strong light around, and the bottom of the river is easily examined.

The advantages of such an instrument will readily occur. Among other interesting ones, the speedy recovery of drowned bodies is one, and it would doubtless be the means of saving many lives. Lost property too may be found, and the impediments to excavation discovered, and their removal facilitated.

CURING DAMP IN ROOMS.

Ripon, April 16, 1824.

GENTLEMEN;—Observing in your late Numbers (30 and 31) two receipts for the prevention of Damp in Rooms, in one of which thin lead is recommended to be put on, with small copper-nails, before papering, I beg to mention, that many rooms in this neighbourhood have been done in this manner, and cured most effectually of the damp. There is a Rolling Mill at Pateley-bridge, in this county, where a very superior article for this purpose is manufactured, and where it may be had at any time. I believe the quantity required does not exceed more than 2½ oz. to 3 oz. per square foot.

J. W.

BOLTING MACHINES.

In the article written by the correspondent signing himself "Bonus Homo" (p. 58, Vol. II), he calculates the number of holes in a square foot of the bolting machine, and takes them to be 43,920 holes, but he should have borne in mind that there are 144 square inches in a square foot; then he, by multiplying 3,660 by 144, would obtain 527,040 holes for a foot square.

G. G.

P. 90, Vol. II., second column, for "gets out of *flour*, as it is termed," read, "gets out of *floor*."

STANDING SHOE-MAKING MACHINES.

GENTLEMEN;—The injurious effect which the sedentary occupations of shoemakers have upon their health, has long been complained of, and it is rather surprising, therefore, that no pains have been taken to introduce methods of working by which the necessity of sitting might be superseded. I now send you descriptions of two machines, both of which have been successfully made use of for this purpose, with the plan of a third of my own invention, which will be found, I think, to combine the advantages of both the others.

Fig. 1 represents a machine which was brought into use by Mr. Parker, as far back as 1804. It is a bench on four legs, about four feet from the ground; V is a piece of wood covered with leather, and stuffed with wool or hair, and fixed to the bench, with holes through it for the strap U to hold the work firm to the cushion, by means of the treadle W, which you work with your foot; X shows the last on the cushion; to the left is an implement used in closing boots; *x* is a small flat leather cushion, used in adjusting the last and strap.

Fig. 2 is another machine for the same purpose, by which Mr. Holden, of Fettleworth, has made more than 2,000 pairs of shoes. A is a bed for the closing-block, to lay the shoe in whilst sewing; B the closing-block; C a loose bed to lay the shoe in to be stitched; the lower part is here represented to show how it is placed in the bed A; D is the upper part of the bed C; E a table for tools; F an iron semicircle, fixed to the bed so as to allow it to be raised or depressed; this half circle moves in the block G; H another iron half-circle, with notches which catch upon a tooth in the centre to hold the block in any angle required; this moves sideways on two pivots at each end of the bed A; it is also represented separately, to show the notches and joints; I the tail or stem of the bed A, moving in a cylindrical hole in the pillar, enabling the bed to be turned in any direction, while, with the movement F, you can place the shoe as you please; K the pillar, formed like a table-claw, excepting that two of the legs stand in a direct line, and the third at right angles with them.

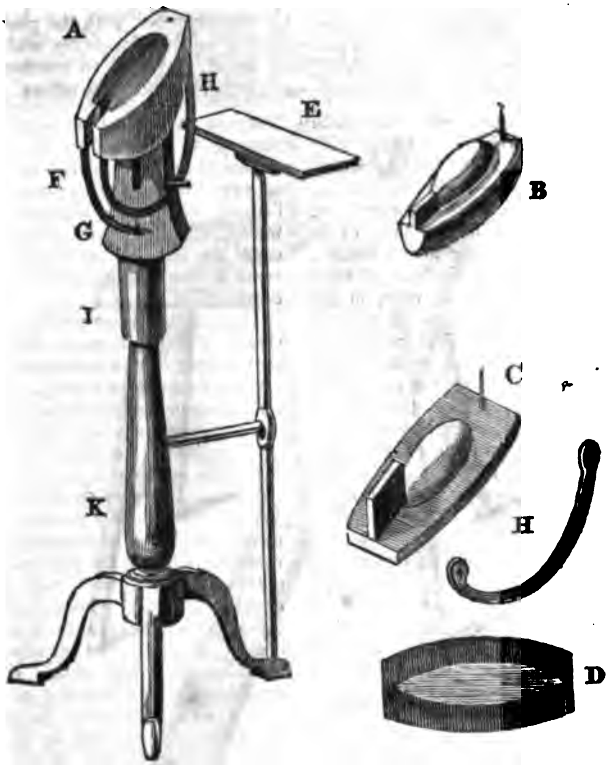
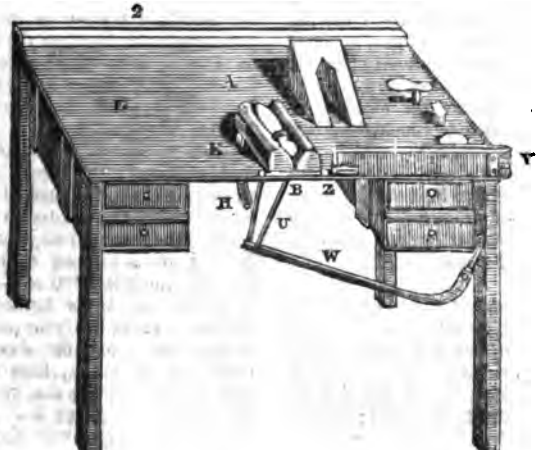


Fig. 3 is a plan for combining the advantages of the other two. E is the working table; A a cushion rising on each side like your thigh, with a hole in the middle for the strap; it moves on two pivots B



round a half circle of iron (H) with holes in it, so that you may raise it or lower it, by putting in a small pin. The cushion may be also raised by placing under it a wedge of wood, as shown to your right, with a notch in it for the strap; U is the strap, with W, a spring, made of iron or wood, and fastened to the leg of the bench, to hold the shoe firm on the cushion, without the help of the feet, as in fig. 1, leaving the legs at full liberty, which I think is desirable. It may be made of a stick and rope, in the same manner as the stone-masons' saws are braced; Y is a pair of clams, made of wood or iron; one piece is fixed firm to the table, the other moves on a hinge at the right-hand end, and is fastened by a button Z, to hold things in while closing the seams; 2 is a rack for tools and knives, and there are drawers underneath for nails, &c. There are also tools on the left hand for nailing toes and heels of shoes, hammering leather, &c.

The workman may have a stool to sit on occasionally if he thinks proper. The table part marked E will serve to cut out on. J. JOHNSON.

CENTRE OF GRAVITY—PENDULOUS BODIES.

GENTLEMEN;—Mr. Deacon does not perceive that my observations on the centre of gravity do not relate to the "main point which he has endeavoured to establish:" my objection is chiefly to the *misapplication* of the expression "the centre of gravity must have a tendency downward," and relates directly to that point. No argument or demonstration founded on this circumstance can be satisfactory to a mechanic who finds that he can practically evade such effect. The tendency of a body downwards in air is its excess of gravity above that of a portion of air of the same bulk; consequently if the specific gravity of a body, or the mean specific gravity of a compound body be equal to that of the air, it will remain at rest; and if it be less than that of the air, its inclination downwards will be minus, that is, it will ascend. I do not mean to say that Mr. D. was not aware of these circumstances; but I wish to impress upon all who are engaged in pursuits of this nature, that *in a demonstration, no fact must be admitted which is not inevitably true.* There is an evident omission in the passage to which Mr. D. alludes; it should be the centre of gravity of every body is *(its weight)* condensed, &c.; but it is more accurate to say, the pressure at that point is equal to that which would be exerted if the whole matter were concentrated in it.

I am rather surprised that Mr. D. should still persevere in his notion, that a body cannot be moved without moving its centre of gravity. Let any rod be suspended on an axis passing at right angles through its centre of gravity; it must be sufficiently obvious that it is capable of motion, though its centre of gravity remains at rest. We are told that if a marble fall perpendicularly on a horizontal stone, its reaction, without the intervention of external impediments, will not be equal to its action. Now, I object to this experiment, because it does not display the influence of *unavoidable impediments,* which should alone be considered. The reaction of a body falling on a fixed plane, is not only "considerably affected by the comparative elastic force of the bodies themselves, as Mr. D. observes, but it possesses no force whatever or tendency to recede, which is not communicated to it by its elasticity. By external impediments must certainly be understood the obstruction opposed to a body after it has received an impulse, not in the absence of impulse, as in the case with non-elastic bodies. If this is what Mr. D. means to convey by the expression "external impediments," it must be improper to place the want of elasticity, which is the want of impulse, under that head. Besides, the supposition that Mr. D. did not intend to include the absence or deficiency of impulse, is fully justified by his following observation, "or rather the whole force of the reaction cannot be made effective," which I conceived to imply, that the force of the reaction was as great as the incident force, but that a part of it was expended in overcoming external resistance.

I am rather disappointed at finding it necessary to return to the subject of pendulous bodies; I hope, however, it will be rendered sufficiently clear by the following observations, which I shall endeavour to express as briefly as is consistent with precision. The most important properties of the pendulum are these :—

1st. A pendulum put in motion would acquire in its descent a velocity which would cause it to ascend to an equal height, and continue to describe equal arcs, if no other resistance than gravity were opposed to it.

2nd. All simple pendulums vibrating in equal arcs of a vertical circle, will perform those equal vibrations in the same time, if their length (which is the distance of the centre of oscillation from the point of suspension) be equal, although their weight be unequal, and their centre of gravity at unequal distances from the point of suspension.

3rd. The shorter vibrations are performed in less time than the longer, and equal vibrations are only locally isochronal, altering their times in different latitudes, owing to variations in the intensity of gravity.

4th. Their momentum is as their quantity of matter into their perpendicular ascent; and the motion derived from equal additions of impulse, will be equal perpendicular ascents, but the spaces described will be unequal.

In all of these properties the predominant characteristic is the influence of gravity, which, I before said, can communicate no impulse to a body moving in a direction parallel to the horizon. A wheel vibrating in the manner of the balance of a watch, does not apply to the original observation of Mr. D., because it was proposed that the centre of gravity should move backwards and forwards; and in a balance it remains stationary, being coincident with the centre of motion.

If Mr. D. carefully considers the above, or any other properties of the pendulum, he will not, I think, discover any analogy between them and a horizontal motion to justify the assertion, that "such a body would come *precisely* within the laws of a pendulum."

remain, Gentlemen,

Your obedient servant,

R. B.

P. S.—If it were my intention to publish my name, I should take pleasure of doing it at the request of Mr. Deacon. I am not aware, however, of any thing that can be gained to the cause of the truth by my doing so.

R. B.

WHEEL-CARRIAGES.

The following communication came in aid of the views of our intelligent correspondent, Mr. Vialls—[See Vol. I, p. 444, and Vol. II. p. 99.]

Dartford.

GENTLEMEN;—I avail myself of the opportunity afforded by the Mechanic's Magazine of communicating what has lain upon my mind above fifty years, and that is, to suggest the necessity of an improvement which might be made upon two-wheel carriages, particularly those drawn by one or more horses. I allude, however, principally to carts drawn by one horse.—In going along a level road loaded, nothing need be said; but when going up or down a hill, particularly if the loading is high, how the poor horse suffers. In going up, especially, the disadvantage he labours under is great, in consequence of the proper bearing upon his back being then taken off and thrown upon the back part of the axletree. Now, to remedy this, I conceive that though the shafts must be, as in the usual manner, fixed upon the axle, yet a method might so be contrived by which the body could be moved backward or forward upon the shafts, so as to bring the proper bearing upon the horse's back, whether going up or down hill. Those of your readers who have been in Scotland may have noticed that the carters there, when they come to the bottom of a hill with a heavy load, are in the custom of getting upon the horse's back, *in order to lighten* its task, unless something equally heavy can be taken from the hinder part of the load and laid upon the shafts before. Absurd as this may at first sight appear, it enables the horse, by restoring the proper bearing upon him, to go up with greater ease, as I have myself repeatedly witnessed. Nay, so true is this, that when a cart has been dragged partly up the hill, and the horse has stuck fast unable to proceed, I have seen the carter mount on its back, when it immediately went forward, and reached the top of the eminence without halting.

In hopes that you will insert this in your Magazine, and that I shall live to see the evil remedied, I am,

Gentlemen, yours truly,

An Admirer of Mechanism, J. J.

WANT OF IMPROVED SIZE-PAPER IN LITHOGRAPHY.

17, Ford Terrace, Lambeth, March 29, 1824.

GENTLEMEN;—In Number 30 of your Magazine, I perceive in the *Inquiries* a letter from "A Paper-maker," on sizing of paper, which suggested to me the propriety of offering the following to the attention of your numerous correspondents, confident of the great benefit which will be derived from some improvement in this important branch of paper-making.

Lithography, or *printing* from *stone*, having become so generally known, few comments on its advantages are necessary. The sized papers now in use are so very injurious to this art, that instead of aiding its improvement, they contribute greatly towards keeping it in the state of mediocrity in which it still remains in this country;* and this obstacle it will be impossible to surmount, unless a sized paper can be manufactured free from both soap and alum. In this art, grease is the very soul and substance, but in the *materials* for *printing* (printing-ink excepted) grease of any sort should carefully be avoided, especially soap. Alum is such an *enemy*, that in no shape whatever can it be introduced in lithography; and until we can have paper quite free of it, we must despair of ever seeing our own country in the productions of this art on a *par* with the continent. The discovery of the improvement wanted, offers a pleasing task to those employed in making of papers, and the result must ultimately prove advantageous both to the manufacturer and consumer.

If the above is worthy a place in your *very valuable work*, you will not only oblige a constant reader, but every other person who is engaged in promoting the simple, but elegant art of lithography.

I am, Gentlemen,

Your obliged and obedient servant,

SAMUEL PARMENTER.

* In France and Germany they have a prepared paper for lithography, with a surface like satin, which produces a most brilliant print; and in these countries, lithography is almost at the meridian of perfection, as may be seen from some of the French prints which are imported.

SARJEANT'S HYDRAULIC FORCER.

Manchester.

GENTLEMEN;—In looking at the figure and description of the Hydraulic Forcer in p. 328, No. 21, Mechanic's Magazine, which your correspondent William represents as economical, it occurs to me that it might easily be made more economical. Economy in this case I take to mean, working a considerable effect with small means. In the first place, is it not a useless waste of water to permit to flow from the pipe A over the bucket B to supply the well? Will not the water necessary for filling the bucket be always more than the pump can want for a supply? Should there not be, therefore, some means taken to stop the water from running from the pipe A as soon as the bucket B is full? Secondly, Might not the 240 lb. weight D be dispensed with, by letting the water from the bucket B, when it had performed its office, there, flow to another bucket, there to act instead of the weight D? Might not the same water be then suffered to run into the well for the supply of the pump? Thirdly, Is the atmospheric pressure able to raise the water in the pump-barrel only a few inches, which, as appears by the figure, is all that it does in this machine? Or is it able in this, as in other pumps, to raise it to a considerable height? By elevating the forcing part as high as the atmospheric pressure will allow, will not the power necessary to raise a given quantity of water be proportionably lessened, or the same power raise a proportionably greater quantity to the supposed height of 60 feet? I should feel obliged to your correspondent William, or any other of your correspondents, who would be kind enough to take the trouble to inform me, whether I am right in any or all of these three points, and if I am, what gain of power or additional effect might be expected to be produced from the adoption of whatever part of them is practicable?

I am, Gentlemen, &c.

JOHN.

[A correspondent in North Wales, speaking of this Hydraulic Forcer, says, "it was put up by a Mr. Spedding for Lord Lowther, at Whitehaven, I make no doubt nearly fifty years since, and I always thought it was his own invention. It is, however, a cheap, simple way of forcing water."—EDIT.]

THE LONDON MECHANICS' INSTITUTION.

The lectures on Chemistry by Mr. R. Phillips, which were announced at the last Quarterly Meeting of this Institution, commenced on Wednesday the 21st inst. The attendance was extremely numerous. "The sight of eight or nine hundred artificers," as *The Morning Chronicle* itself, a most munificent contributor to the funds of the society, truly remarks, "thus collecting, after their daily toils are over, to listen to the voice of science, is something new in this metropolis, and marks an era in the history of its population that future historians will dwell on with pride. Nor can the statesman, or the chronicler of the times, overlook it with safety or propriety. The former must perceive, that when men can appreciate the abstract truths of science, they can only be governed by reason, and will easily see through the common-place cant of common-place politicians. They must no longer expect to fire them with the spark of enthusiasm, or compress them into dullness and inaction by the leaden bands of superstition; and they must be convinced, that ultimately they can only preserve power by adopting measures which, after being canvassed and discussed, shall be thoroughly approved. The change which is indicated in the manners of our people, by their hastening in the evening to attend scientific lectures, must be pregnant with great future improvement. Some portion, perhaps, of the good behaviour of the people might arise from the nature of the lecture, which was clearly delivered and made interesting from beginning to end. Numerous experiments, which were well performed, while they elucidated the principles of the science, materially contributed to the pleasure evidently felt by the audience."

After Mr. Phillips' second lecture on Wednesday evening last, Dr. Birkbeck announced to the meeting that the Society of Arts had made the Institution a present of a complete copy of their transactions, and that Sir Francis Burdett had sent them 100 guineas. These two gifts were acknowledged with loud applause. The society is not only increasing in wealth and numbers, but in celebrity. Mr. Brougham is almost always present, encouraging, by his own deep attention to the lectures, the attention of others. On Wednesday night he was accompanied by Mr. Dumont, from Geneva, a gentleman well known in the literary world as the editor of several of Mr. Bentham's treatises. We also observed two or three other distinguished visitors.

CHILIAN SMELTING FURNACE.

From Captain Hall's Journal, written on the Coasts of Chili, Peru, and Mexico—(Just published).

The smelting furnace resembles a small lime-kiln, covered at top with a sort of dome, open on one side, and terminating in a chimney. The copper-ore being broken into small pieces of the size of a walnut, is placed in alternate layers with fire-wood, till the whole is filled up to the open space. The wood being kindled, a steady blast is introduced beneath from two pairs of bellows, worked by cranks, attached to the axis of a water-wheel. The wheel is of a slight construction, and, instead of being fitted with buckets, is encircled with a series of projecting boards, shaped like spoons, upon which the water which falls in a perpendicular stream, is made to play. When the ore is all melted, it is allowed to run out at a hole in the lower part of the furnace, closed up by clay during the melting, and now opened in the usual way, by making an orifice with a heavy iron bar. The metal, which at this first operation comes out in a very impure state, is thrown into water while hot, and is afterwards scraped by iron instruments, to remove the slags and dross. It is then melted in the refining furnace, and drawn off into moulds about twenty inches long, twelve wide, and three or four thick. In this state it is exported.

KEDGING, OR A NEW MODE OF SAILING.

(*From the same*).

The manner in which we proceeded down the river is so curious, and as far as I know rare, that I shall attempt to make it intelligible to readers not nautical.

In the navigation of rivers with many windings and shoals, the chief danger is, that the tide will force the ship either on the bank, or on some shoal; and this will happen although she be under all sail, and with a good breeze of wind; for the tide sometimes runs so rapidly, as to bustle the ship on shore, before the sails can be made to act. When the wind is blowing faintly, and is not quite fair, the danger of this happening is much increased. On such occasions, instead of sailing in the usual manner, with the ship's head foremost, no sails whatever are set, and the stern is made to go first, an operation technically called Kedging.

If when a tide is running, the anchor by which the vessel is riding be raised off the ground, she will, of course, immediately begin to drift along with the stream, and ere long, most probably run aground upon one of the shoals. The ship, it must be observed, when under these circumstances, can make no progress through the water, but is drifted along like a log; and consequently the rudder can have no effect in directing her course; she is, in short, entirely at the mercy of the tide. The operation mentioned above, is a device to produce a relative motion between the ship and the water, in order, by that means, to bring the directing power of the rudder into action. This is accomplished by allowing the anchor to trail along the ground, instead of lifting it entirely up as in the first supposition. It is known as a nautical fact, that the degree of firmness with which an anchor holds the ground depends, within certain limits, upon its distance. When it is immediately under the bows, that is, when the cable is vertical, it has little or no hold; but when there is much cable out, it fixes itself in the bottom, and cannot be dragged out of its place. In the operation of kedging, the cable is hove or drawn in, till nearly in an upright position; this loosens the hold of the anchor, which begins to trail along the ground, by the action of the tide pressing against the ship. If the anchor ceases altogether to hold, she will, of course, move entirely along with the tide; but if it be not quite lifted up, and merely allowed to drag along the ground, it is evident that the ship thus clogged, will accompany the tide reluctantly, and the stream will, in part, run past her. Thus, a relative motion between the vessel and the water is produced, and consequently a steering power is given to the rudder.

In our case the tide was running three miles an hour; and had the anchor been lifted wholly off the ground, we must have been borne down the river exactly at that rate; but by allowing it to drag along the ground, a friction was produced, by which the ship was retarded one mile, and was, therefore, actually carried down at the rate of only two miles, while the remaining one mile of tide ran past, and allowed of her being steered, so that in point of fact she became as much under the command of the rudder as if under sail, and going at the rate of one mile an hour.

This power of steerage enabled the pilot to thread his way among the shoals, and to avoid the angles of the banks; for by turning the ship's head one way or the other, the tide was made to act obliquely on the opposite side, and thus she was easily made to cross from bank to bank in a zig-zag direction. It will sometimes happen, that with every care, the pilot finds himself caught by some eddy of the tide, which threatens to carry him on a sand bank; when this takes place, a few fathoms of the cable are permitted to run out, which in an instant allows the anchor to fix itself in the ground, and the ship becomes motionless. By now placing the rudder in a proper direction, the tide is soon made to act on one bow, the ship is sheered over, as it is called, clear of the danger, and the cable being again drawn in, the anchor drags as before. The operation of kedging requires the most constant vigilance, and is full of interest, though rather a slow mode of proceeding; for it cost us all that night and the whole of the next day and night to retrace the ground which we formerly had gone over in ten hours.

GOLD MILL.

(From the same.)

In the course of our walk we discovered a grove of trees near the stream, in the centre of which stood a neatly built cottage, surrounded by a farm-yard, offices, and garden, with every thing in the most rural style, except a gold-mill, which, though characteristic enough of Copiapó, certainly looked somewhat out of place. This establishment belonged to a man who was making a sure fortune by a copper-mine, till, unfortunately, it gradually degenerated into a mine of gold. From that moment the tide of his fortune turned, and has been ever since on the ebb. This, which at first looks a little paradoxical, is precisely what might be expected, for it is the scarcity of gold, the uncertainty of its extent in any given situation, and the consequent great cost of production, which, while they give it so high an exchangeable value, render mining speculations in gold invariably hazardous. In these countries, therefore, it has become a common saying, that a diligent man who works a copper-mine is sure to gain; that he who works one of silver may either gain or lose; but that, if the mine be of gold, he is certainly ruined.

The mill consists of an upright shaft, or spindle, the lower end of which is fixed to a horizontal water-wheel, working in a sunk water-course, and giving a rotatory motion to the spindle, which passes through the centre of a large circular trough on the ground. In this trough a mill-stone is carried round upon its edge, on a horizontal axis projecting from the spindle. Small pieces of the ore are thrown into the trough, kept full of water by a constant small stream; and when the machine is put in motion, the stone goes rapidly round, crushing and grinding the ore under the water. As soon as the whole is reduced, by this process of trituration, to a fine mud, quicksilver is added, and an amalgam is soon formed, by its union with the detached particles of gold. This process is said to be quickened by the agitation of the water, and the friction of the mill-stone. The water is allowed to trickle off by a nick cut in the edge of the trough, and is received in long wooden channels covered with course cloths, the folds and irregular parts of which catch any stray portions of gold, or of the amalgam, which the agitation of the water may have thrown out of the trough. When all the gold is supposed to be combined with the quicksilver, the water is drawn off, and the amalgam being exposed to heat in vessels adapted to the purpose, the quicksilver is distilled off, and the gold remains behind in a pure state.

TO PRESERVE WATER AND MEAT FROM PUTREFACTION IN LONG VOYAGES.

The crews of the two Russian ships which lately sailed round the world were extremely healthy; during the whole three years of their voyage, only tw men died of the crew of the Neva, and the Nevashda did not lose a single man. It is already known that their fresh water was preserved in charred casks, but it is not so generally known that they used the same precaution for preserving their salted provisions. The beef they carried out with them tasted as pleasantly upon their return as it did three years before, when first salted.

F. G.

ANSWERS TO INQUIRIES.

No. 6.—STONE SAWING.

In answer to your correspondent who wishes to know where he can see a stone saw-mill, &c. I beg to state, that I know of no plan better calculated for his information than the marble works at Kendal, Westmorland, conducted by Mr. F. Webster, in a neat and expeditious manner.

R. W.

NEW PATENTS.

To Richard Evans, of Bread-street, in the city of London, wholsale coffee dealer; for a method or process of roasting or preparing coffee and other vegetable substances, with improvements in the machinery employed; such process and machinery being likewise applicable to the drying, distillation, and decomposition of other mineral, vegetable, and animal substances, together with a method of examining and regulating the process, whilst such substances are exposed to the operations before mentioned.—Sealed Feb. 28, 1824.—six months.

To William Yetts, of Great Yarmouth, merchant and ship-owner; for his invention of an apparatus for securing the windlasses of ships.

To Charles Bageuell Fleetwood, of Parliament-street, Dublin; for a liquid and composition for making leather, and other articles, water proof.—Dated Feb. 28, 1824—six months.

To Maurice de Jough, of Warrington, cotton-spinner; for a mode of constructing and placing a coke-oven under or contiguous to steam or other boilers; so as to make the heat, arising from making coal or other intense combustion in the said oven, subservient to the use of the boiler, instead of fuel used in the common way; and to exclude such heat from the boiler, when required, without detriment to the operations of the oven.—Dated Feb. 28, 1824—two months.

To Joel Spiller, of Chelsea, for an improvement or improvements in the machinery to be employed in the working of pumps.—Dated March 6, 1824—four months.

To John Heathcoat, of Tiverton, lace-manufacturer; for a new method of manufacturing certain parts of machines used in the manufacture of lace, commonly called bobbin-net.—Dated March 9, 1824—six months.

To John Heathcoat, of Tiverton, for an improved economical method of combining machinery used in the manufacture of lace, in weaving, and in spinning, worked by power.—Dated March 9, 1824—six months.

TO CORRESPONDENTS.

Our friend Nicol Dixon is requested to send again to our Publishers; a packet has been lying there for him several weeks. It is addressed to him, however, by his *Christmas* name. We hope to hear from him when he receives it.

If P. A. S. will lead the way, as he proposes, we are convinced he will not only confer a great obligation on our readers, but have many to join him in the good work.

R. B.'s offered Letters will be acceptable.

.. H. wishes to know "where the Pedomotive Carriage, mentioned in our 34th Number can be seen," as he wishes to purchase one, considering it the best thing of the kind that has yet been invented.

The drawing necessary to illustrate W. G.'s ingenious paper, is forwarded to the Engraver.

Our Dundee correspondent will not, we trust, be displeased at our omitting the addition to his valuable paper relating to the Arithmetical Question. It would have tended to revive a discussion which was carried quite far enough.

Several articles prepared for insertion in this Number are unavoidably postponed.

THE PRIZES.

For the satisfaction of several correspondents belonging to trades not included among those to which we have offered Prizes, we beg to state, that, encouraged as we hope to be by a continuance of the public favour, it is our intention to offer a similar list of Prizes every year, so that those who may not be invited to compete this year, may hope to be included the next.

We are not aware that there is any thing in the conditions which should exclude N. D. from competing for *both* the *Essays*, but we would recommend to him to be content with making sure of one.

Communications received from G. D.—Nauticus—Northumbriensis—X. Y. Z.—A Tyro—Billy Smith—Omega—H. S.—Juvenis Inquiribus—W. Veales, Jun.—W. H.—T. Newbolt—A Schoolmaster—A Weekly Subscriber—S. M.—N. A.—Edward Cary—A. F. S.—Charles Slee—A Steamer—U. U. D.—Mr. Utling—R. T.—Mr. Pasley—A Carpenter.

Communications (post paid) to be addressed to the Editors, at the Publishers.

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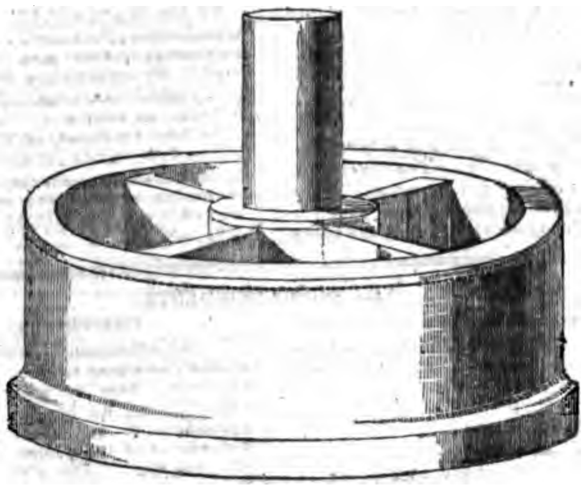
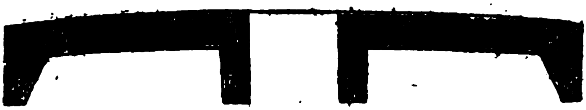
Museum, Register, Journal, & Gazette.

Let the proudest natural philosopher, or the profoundest mathematician consider, that although he may be justly delighted with the extent of his own views, yet, without mechanical performances, all his refined speculations would prove but as an empty dream.—Butler. S. K.

No. 37.] SATURDAY, MAY 8, 1824. Price 3d.





PLAN TO PREVENT CORROSION OF THE WORKING PARTS OF STEAM-ENGINES.

GENTLEMEN;—I send for insertion in the Mechanic's Magazine a plan which I discovered some time ago, and which I have had in constant use since the discovery, for preventing the ill effects of mineral water on the working parts of steam-engines, subject to its action.

The air-pump bucket of a large engine (steam cylinder 50 inches diameter) to which I have adapted the plan, was previously rendered useless by corrosion in a very short space of time, so as to require its frequent renewal. I have now one at work that has been in use several months, and seems as yet little or nothing the worse.

The plan I allude to, consists in forming those parts liable to corrosion, which in an air-pump bucket will be the seat on which the valve works, and the corresponding surface of the valve itself, of brass. This may readily be done in making the bucket, by first of all running into the mould as much brass as will form a sufficient ring of that metal (that part, of course, being moulded downwards), and then filling up the mould with iron. It requires both care and nicety to seize the proper moment for pouring in the iron. If too much time is allowed to elapse after running the brass, the latter will have set, and the union of the metals will be imperfect; and if the iron is poured in too soon, there is a danger (especially if not poured in quietly) of its mixing with the brass, and forming spots, which will of course, corrode and defeat your intention.

If successfully done, the union of the two metals will be complete, though the limits of each will be perfectly defined in the fracture. By adopting this mode, I now have heavy iron valves, with brass faces, substituted for expensive ones of brass only. The prefixed sketch will help to explain my meaning. The upper part of the principal figure, marked by the dotted line, is to be of brass—perhaps one inch in depth—on this the valve plays. The figure underneath represents a section of the valve, the upper parts of iron, and the under ones of brass, as marked off and distinguished by a lighter shade. I think the plan a valuable one, and therefore wish it to be made public.

I am, &c. &c.

W. H. B.

EMIGRATION OF ARTIZANS.

Extracts from the Evidence.

(Continued from p. 26).

Mr. Thomas Osler, one of the deputation from the Chamber of Commerce, of Birmingham, examined—

What is your business?—I conduct two distinct businesses, a glass trinket manufacturer, and a chandelier furniture manufacturer.

How many years have you been in business?—Nearly eighteen years.

Do these trades necessarily connect you with other and different branches of manufacture?—Yes; with the jewellers, with the gilt toy-makers, and with fancy button-makers.

Is it your opinion that the emigration of artizans would materially affect the town of Birmingham?—It is.

Will you be so good as to state any fact in support of that opinion?—Two or three branches of trade have been altogether lost to the town of Birmingham, in consequence of the emigration of an exceeding small number of artizans; and perhaps I may be here permitted to state, that it is the peculiar character of the manufacturers of Birmingham to be capable of transportation by an exceedingly small number of persons.

In what branches?—There is a fancy-cut white metal button; it is cut by an engine, a showy and cheap thing, of which I have brought specimens; a few years ago that employed between forty and fifty houses in the manufacture of that article chiefly.

What number of men do you suppose were employed?—Different numbers, varying from twenty to forty men in each house. A manufacturer, a man of small property, but who perfectly understood the trade, was detained by Buonaparte, with other Englishmen, at Verdun, from whence he made his escape. He was apprehended, and brought back, and a second time went from Verdun, and found his way to Paris, where he stated to the government his ability to establish this branch of manufacture.

In what year was this?—I cannot speak to the exact year; it must have been before 1814. He was patronized by the French government, and France has now for some time supplied all Europe with that article, and distant markets; there are none of them now made in Birmingham.

That trade is entirely lost to Birmingham?—It is.

Do you know what market you had at the time Birmingham supplied them; were they used in England?—I believe scarcel at all in England; I am now speaking from the evidence of others. A man of the highest respectability, my next door neighbour, one of the largest button-houses in Europe, furnished me with particulars.

What is his name?—Ledsam.

Do you know how many button-manufactories there are in France?—Chiefly at Paris for that kind of button.

Do you know how many men are employed there?—I cannot speak to that fact; I know that they used to be made there. Mr. Ledsam assures me, that they are still extensively used on the continent.

Did these buttons go to other places besides Paris, previously to the loss of the trade?—Yes; Germany, and Italy, and Switzerland.

Did that manufacture exist in France before it was removed from Birmingham?—No.

You are not able to say how many men are now employed in France making these buttons?—I do not know; I am only informed there is a very considerable manufactory kept in active employment in Paris.

Do you know to what other parts of Europe they send those buttons?—I am informed Germany, and Italy, and Switzerland.

Do you know who conducts the manufacture at Paris?—An Englishman; I cannot speak with certainty to his name. This is a button of his manufacture (producing the same), and he gave currency to the article at first, by using the mark of a Birmingham manufacturer, the Prince's feather.

Is it to be understood that they were, in fact, introduced as if they had been English manufacture, by having an English mark upon them?—That I cannot say; but it may be fairly presumed the Prince's feather was a mark well known at the back of buttons as a mark of a house in repute on the continent, and he stamped it upon them.

You infer from this fact, that notwithstanding their long establishment, and increased advantages from skill, capital, and industry, the manufacturers of Birmingham would not be able to resist foreign competition?—In the present state of circumstances, I conceive they could not, as long as provisions retain their present price, and there exists taxes or restrictions on the raw material. There are a variety of other circumstances to be considered.

What tax on the raw material of buttons is at present affixed?—English silver pays a duty of fifteen pence an ounce. I speak with reserve on subjects which I do not myself know: this I was informed by a respectable silversmith now in London, that English silver pays a duty of fifteen pence per ounce; but copper also is very extensively used; it forms a large proportion of the raw material in both gilt and plated buttons. Now, copper, I am informed, may be brought from Peru at 60 per cent less than it can be produced in this country; but it is excluded by the duties for the protection of the mining interests in Cornwall.

Are there any other burthens which you consider the button manufactory to labour under?—The price of labour, as affected by taxation. There is another article, of which twenty thousand gross were made a week in Birmingham, which has been lost in the same way, that is called the Bath metal drilled shank button; the button is cast whole, then stamped, and the shank drilled. I am informed by Mr. Ledsam, that twenty thousand gross weekly used to be made in Birmingham.

For what market?—The foreign market.

Do you know what are the wages that are paid for the manufacture of buttons in Paris?—I cannot speak to that.

What are the wages paid in Birmingham?—A great variety of hands are employed in the manufacture of a button, all of which receive different rates of wages: there is the piercer, the cutter, the stamper, the gilder, and the burnisher.

There are the same different kinds of workmen in Paris, employed in making buttons, probably?—I should suppose so.

How much lower are the wages in Paris than in Birmingham?—I cannot state; but we know that when the French or any other continental power have the means of manufacturing an article, we cease to export it, and our inference is, that labour and raw material must be cheaper.

You state, that whilst wages and provisions are lower in Paris, they must undersell you in Birmingham; are you able to give any information with reference to provisions?—No.

If you were told it had been given in evidence in this Committee, that an artizan could live cheaper in Staffordshire than in Paris, having every comfort alike, should you believe that?—I should feel great difficulty in believing that. I should beg to observe, that a French artizan will live upon very much less than an English artizan: their habits are exceedingly different. I have been informed by respectable manufacturers who have visited Paris, that a French artizan will live for a considerably less expense than an English one.

Do you know whether a French artizan will work as much as an English artizan in the same time?—I cannot conceive there can be any very great difference, at least in the manufacture of such articles as are usually made in Birmingham. From my knowledge of the Birmingham trades, I should say, that a native of any country in Europe, possessing ordinary bodily power, and employed at almost any of the trades carried on in Birmingham, would be able to work as fast as an Englishman.

That is your opinion?—Yes.

Do you know the difference of price between this button made in Birmingham and in Paris?—I do not.

Would you not conceive it very probable that an English artizan would live cheaper in Staffordshire than in Paris?—Perhaps he would. I am not acquainted at what rate malt-liquor can be had there; he would like to have his beer and his beef. But those buttons cannot have been made by English artizans; they have been made by French artizans, instructed by one or two Eglishmen. If the Committee will indulge me with permission to make one observation, I would say, that the rate at which an Englishman may live in Paris, has really very little to do with this question: the mass of the labour is French; they were only set in motion by one or two Englishmen.

How do you know that fact?—Because they were made at a time when scarcely any Englishmen were in Paris, under the government of Buonaparte.

Do you know of any people going from Birmingham?—I believe I am warranted in saying, that an exceedingly small number indeed have emigrated. But I fear, that if foreigners were instructed in the various processes of our manufactures, nineteen-twentieths of the Birmingham manufactures for exportation would gradually cease to be made in England, by degrees; and the foreigners would have the trade, to the exclusion on the continent of Englishmen.

You state that there is another sort of button which has been lost to Birmingham; is that still made?—I am informed that it is still much used.

Where is it made?—In France I understand.

In what part of France?—Near Paris.

Do you know whether that was introduced by English artizans?—Yes.

How long ago?—Within these five or six years.

Since the peace?—Yes.

Do you attribute that to English machinery carried abroad, or English artizans?—Combined causes; it is most likely that they took over a stamp and press with them.

Have you reason to believe that they took over any English machinery with them?—No; but I know the machinery employed in making that button is so exceedingly simple, that it may be readily made any where; and one or two button-makers would be quite sufficient to inoculate five or six hundred men with sufficient knowledge to make the article.

Could not they have done it without having any of the Birmingham artizans?—The fact is, that they did not do it; and we infer, that as they did not do it till those men went there, they would not have done it if they had not gone there.

Do you consider it to have originated with the same men as the first you referred to?—No; a man who went five or six years ago from the house of Mr. Richard Smith, Birmingham.

Do you know the man's name?—No.

Have you reason to believe that that man commenced his manufactory at Paris?—Somewhere near Paris.

Do you know whether these 20,000 gross were used in England, or to what parts they were sent?—Different parts of the continent—Germany, and Switzerland, and Italy.

Do you know whether any particular change has taken place in not using the buttons which were formerly used?—There is no doubt fashion has changed within five or six years; but I am informed that the Bath metal button is still extensively used on the continent.

Do you recollect any extensive buckle manufactory at Birmingham?—It was rather before my time.

There was a very extensive buckle manufactory?—Yes.

Is that lost now to Birmingham?—Nearly so.

Do you know to what place it has gone?—The trade scarcely exists; change of fashion has extinguished it.

Do you not conceive that if a French manufacturer had seen those buttons, he would have been able to imitate them, though neither he nor his workmen had been instructed by an English artizan?—I can certainly believe it possible; but we rest our inference upon the fact, that up to a certain time there was a great demand for that article in this country for exportation: and that dating from the time these two or three men went abroad, the demand gradually and speedily ceased.

How do you arrive at the knowledge that the man used the feathers?—He told his former master so himself. There is a very different mode of manufacture of those two buttons I have produced; the first is made by a process altogether unlike to that employed in the yellow button. I do not believe that the French, or any other nation, would have been able to bring that button into the market at a saleable price, unless they had been instructed by an Englishman.

What do you conceive to be the population of Birmingham and the adjacent manufacturing districts?—From a hundred and thirty to a hundred and fifty thousand. I do not include the coal district of Staffordshire, nor the iron district, but only the district making the light hardware manufactures of which I have been speaking.

Have you an idea that of this large number many would be induced to emigrate?—No, very few.

Then is it possible, that the emigration of so trifling a number would be seriously prejudicial to the remainder?—That is my conviction, certainly.

Why?—Because the processes which form the basis of these several branches of trade which give employment to many thousand persons, actually rest in very few hands indeed; they may be communicated by an almost incredibly small number of persons. I will beg to trouble the Committee with a sight of a few of them: there is an article (producing it). It is an imitation of engraving on stone; those impressions could not be given to real stones but at the expense of from a guinea to 30s. each, if executed by a tolerable artist; we produce them for three half-pence, the mounting of those furnishes employ to a very large number of hands indeed: now, the means of giving those impressions to glass, which form the basis of all those trades, may be communicated by one or two persons to 20,000.

Therefore you conceive it would be injurious to permit artisans to go abroad?—I do.

Do you know that artisans do go abroad?—Certainly.

Do you know of any means of preventing them?—Not absolutely; but that I conceive to be the business of the legislature. This (producing it) is an article, which has employed a very large number of persons in Birmingham: what were called Maltese buttons, were made of these beads.

Of what are those made?—Of glass, called satin glass; I believe the mode of preparing this glass is confined at present in Birmingham to two individuals, who know the secret; one of them is in our service. If these men had been taken from Birmingham a few years ago, we should in all probability have lost a very important though temporary article of Birmingham manufacture. In every thing relating to glass in particular, we should be successfully rivalled by the French, in consequence of there being no duty on their glass, the drawback being quite unavailing to articles of this description. The raw material which we employ in making articles of this kind, costs me from two to three shillings a pound; if it were not for the duty, I might buy it at a third of that price: foreigners use a material which pays no duty.

How long has this trade in glass ornaments been in Birmingham?—Fifty or sixty years at least, but within the last 30 years it has been astonishingly increased.

There is little or no machinery used in it?—Very little machinery. I have brought with me some French articles (producing them): what appear to be gilt beads, are merely glass ones; and what appear to be plated beads, are merely the same material. If they had the means of instruction in other branches of business, I think they must successfully compete with us. I cannot afford to sell that under fourteen pence, whilst the other article is produced in France at three half-pence.

What market is there for these articles out of Britain?—Occasionally a very extensive market: we send some to the East Indies; but merchants are very reserved in explaining to manufacturers the precise spot to which their orders are consigned; but I have sold to a merchant in London a very considerable number of Maltese buttons made of these articles, which I understand were designed for the East Indies.

Do you mean to say that the French make them as good as you do?—I believe they do not make the articles I have in my hand at all; but I believe, that if they were instructed by English artizans, they would produce as good articles at a much cheaper rate.

There is no great art in the making of them, if they have a person to instruct them, is there?—No, there is not.

If the difference existed which you have stated, in the price of articles of considerable demand, of from 2d. to 14d., do you not conceive that would be so strong an inducement, that a manufactory for them would be established in France, with very little difficulty?—One would suppose that would be the case, but facts seem to indicate the contrary; they have soon learned to press the little pieces of gilt metal into which those are put to make seals, but they send to us for the glass; and they do from America. If they had the means of making them at home, we should hear no more of their orders.

Am the Committee to understand, that the glass you make is of a nature they cannot imitate?—The manufactured article they cannot get at present but from this country. The raw material they can get three or four hundred per cent cheaper than the English manufacturer can; and consequently, if they had the means of manufacturing it, their order would cease.

Is there any thing else you have to state upon this subject?—Gentlemen may consider the articles on the table as extremely insignificant, but perhaps I may surprise them a little by mentioning the following fact. Eighteen years ago, on my first journey to London, a respectable looking man in the city, asked me if I could supply him with dolls' eyes; and I was foolish enough to feel half offended; I thought it derogatory to my new dignity as a manufacturer, to make dolls' eyes. He took me into a room quite as wide, and perhaps twice the length of this, and we had just room to walk between stacks, from the floor to the ceiling, of parts of dolls. He said, there are only the legs and arms, the trunks are below. But I saw enough to convince me that he wanted a great many eyes; and as the article appeared quite in my own line of business, I said I would take an order by way of experiment; and he showed me several specimens. I copied the order; he ordered various quantities, and of various sizes and qualities. On returning to the Tavistock Hotel, I found that the order amounted to upwards of £500. I went into the country, and endeavoured to make them. I had some of the most ingenious glass toy-makers in the kingdom in my service; but when I showed it to them, they shook their heads, and said they had often seen the article before, but could not make it. I engaged them by presents to use their best exertions; but after trying, and wasting a great deal of time for three or four weeks, I was obliged to relinquish the attempt. Soon afterwards I engaged in another branch of business (chandelier furniture), and took no more notice of it. About 18 months ago I resumed the trinket trade, and then determined to think of the dolls' eyes; and about eight months since, I accidentally met with a poor fellow who had impoverished himself by drinking, and who was dying in a consumption, in a state of great want. I showed him ten sovereigns, and he said he would instruct me in the process. He was in such a state that he could not bear the effluvia of his own lamp; but though I was very conversant with the manual part of the business, and it related to things I was daily in the habit of seeing, I felt I could do nothing from his description. I mention this to show how difficult it is to convey by description the mode of working. He took me into his garret, where the poor fellow had economized to such a degree, that he actually used the entrails and fat of poultry from Leadenhall-market to save oil (the price of the article having been latterly so much reduced by competition at home). In an instant, before I had seen him make three, I felt competent to make a gross; and the difference between his mode, and that of my own workmen was so trifling, that I felt the utmost astonishment.

You can now make dolls' eyes?—I can. As it was eighteen years ago that I received the order I have mentioned, and feeling doubtful of my own recollection, though very strong, and suspecting that it could have been to the amount stated, I last night took the present very reduced price of that article (less than half now of what it was then), and calculating that every child in this country not using a doll till two years old, and throwing it aside at seven, and having a new one annually, I satisfied myself that the eyes alone would produce a circulation of a great many thousand pounds. I mention this merely to show the importance of trifles; and to assign one reason, amongst many, for my conviction, that nothing but personal communication can enable our manufactures to be transplanted.

You give this instance, which you think may be applied generally?—I think it may be applied generally to those light trades of Birmingham to which my observations are directed.

In Birmingham there is a method of making button-shanks by a machine?—There is.

Do you know what the price of button shanks was before the discovery of that method of making them by steam-engines at one blow?—No, I have used a great many button-shanks, for which I used to give 2½*d.* a gross; but they were not made, nor could they be made by this engine.

Do you know whether this secret has gone abroad yet to any part of the continent?—I am not aware that it has; all day long it throws off four score a minute. In making the Maltese buttons I alluded to, ten or twelve separate branches of trade are kept employed in mounting that button.

Do you recollect any other branches of trade lost to Birmingham within the last twenty years?—No; a German of the name of Antrie, came to this country a few years ago, and connected himself with one of the clerks in a respectable mercantile house, and became sufficiently conversant through this means with the button and gilt toy trades. He carried on those businesses for four or five years, and then removed to Germany. He has taken, I believe, not more than three Englishmen with him; but I am informed he has now an extensive manufactory near Frankfort, where gilt toys and buttons are made after the English mode; and within these few months he has commenced a manufactory of brass nails after our plan, on a very large scale.

Has he English artizans with him?—Yes, two or three. Some few years ago, Germans resident for a short time in England, for commercial purposes, paid particular attention to the brass foundry trade. They were pepetually visiting brass founders' work-shops, accurately noticing the different processes, taking notes, &c. The exportation of brass foundry to Germany is at present nearly lost to Birmingham, very little bass foundry being sent there now, except as patterns. If a new article comes out, patterns are sent for, and perhaps accompanied by a small order to give a colour to the request; but the orders are seldom or never repeated, though brass foundry is extensively used in Germany.

Do you know in what parts of Germany

the foundries are established?—Along the Rhine.

Do you conceive, that if the artisans were allowed to quit the country, more men would go than now?—Yes, many more.

What prevents their going at present?—There is in many minds a feeling that it is discreditable; there is an honourable feeling against transplanting the manufactures of their own country to foreign countries.

With whom does that feeling exist?—I believe it is with the workmen; and besides, the person enticing them knows he is subject to severe penalties, and that his operations must be conducted secretly.

Have you known any person punished for attempting to seduce artizans, during the 17 years you have been in business?—Of my own knowledge I do not; but I cannot too earnestly impress upon the Committee, that I have been sent before it at a moment's notice, and without having the information I ought to have had, and which I am persuaded I could have been furnished with in a few days.

One of the resolutions agreed to at a public meeting at Birmingham, on the 12th of March, from which you are deputed, objects to the laws being repealed which now prevents artizans emigrating; at that meeting, or in the committee appointed to carry those resolutions into effect, were any cases stated to you, where prosecutions have been instituted at Birmingham against artizans going abroad, or against persons for enticing them to go abroad?—I have not heard of any, but I should say, that peculiar circumstances occurring within the last few days so completely occupied my time, that I did not attend this meeting of the Board of Directors.

Did you receive any instructions of individual cases, to support you in your statements before this committee?—Only those which I have stated; I am not aware of any prosecutions, but I have a strong conviction of the impolicy of permitting our artizans to emigrate, for the reasons I have mentioned.

Are you able to state whether it was stated by the committee, or at the meeting, whether any means could be devised to prevent artizans emigrating if they chose?—It was admitted the subject was attended with very great difficulty, that, perhaps it would never be possible entirely to prevent the emigration of artizans; at the same time it was deemed possible to render it more effective than it is; at all events, that many more men would emigrate if that feeling which now exists were taken away, and if agents were permitted to establish themselves at Birmingham, for the purpose of tempting the men without restriction.

Are you aware that any agents are established now at Birmingham for that purpose?—I am not aware that agents are established now for that purpose, but I know that men have been sent there for that purpose; and that the wives of three or four artizans are at present known to go to particular places, and receive a weekly stipend, in consequence of the absence of their husbands on the continent.

Are you able to speak to any particular instances where persons have been enticed away?—I cannot generally name the parties, nor the date, but I have no doubt I should be able to give them to the Committee.

Have you known any masters in you trade go abroad and establish their business in any part of the world?—Not from Birmingham.

You have stated that you are apprehensive several branches of the trinket trade would suffer if artizans were allowed to go abroad?—Yes.

Do you know the state in which the trinket trade is in France, compared with that in which it is in England?—I believe both are very flourishing.

Do you know whether trinkets, generally speaking, are cheaper in France or in England?—In France.

If they are cheaper, what fear have you of your trade being interfered with, if artizans are allowed freely to go?—Because, whilst I admit that trinkets are cheaper in France, I know that the French do not make a great number of trinkets (which have arrived at considerable perfection in England) at all. What they can make, they make cheaper than we can; but we make many which at present they cannot make at all; and if the emigration of artizans were facilitated, I think we should lose those branches also.

Are you able to state whether French artizans in trinkets are equal or inferior to the English artizans in trinkets?—The character of style of work in the two countries is extremely different; in light ornamental fillagree work, the French, I apprehend, excel us.

Is not the fillagree work to which you allude, the finest kind of work?—Not exclusively; it is amongst the finest and most expensive.

If they excel us in the finest kind, what reason have you to think they would not equal us in the inferior, if there was a demand for those articles?—They have neither the machinery nor many other kinds of facilities for making the more solid kinds of jewellery. The cheaper and more solid descriptions of trinkets can be made with much greater facility in England than they can be in France: they require dies, presses, and other species of machinery, which I believe they do not at present possess. If they had those, and were instructed in our mode of working, I dare say they would successfully rival us.

Do you know whether, in many of the finer kinds of trinkets in which the French excel, they have dies for that purpose as well as you?—I believe the more costly species of French is made with very little assistance indeed from machinery, but principally by exquisite manual skill.

Do you confine yourself to the dies?—No.

Do you mean that you excel them in die sinking?—In die-sinking I think we do.

Have you ever seen any of the dies struck in France?—Yes.

Have you seen any of the medal-dies?—Yes.

Are you able to state whether the English or the French are superior?—The French, decidedly.

If they are superior in the manufacture of those medal-dies which you have seen, what induces you to think that they could not make dies of an inferior nature, if they had any demand for them?—It is my opinion that they could, if they saw the kind of dies we are in the habit of using, and had two or three English die-sinkers, who are a perfectly distinct race of artizans from a French medallist; a man who may be a most excellent medallist would not condescend to sink dies, which are got finished for three or four shillings.

Will not men work for those who pay them? and if there should be dies required of an inferior nature, do you not conceive there would be great facility in the expert hands making the inferior work, if they were well paid for it?—It does not accord so much with the French style of work, the sinking those low-priced dies; there is very heavy work in them, and the die forms only one part of the impediment; for it is useless, unless accompanied by an extensive set of tools, for cutting-out and piercing that part which the die leaves unfinished.

(*To be continued.*)

Process for rendering Leather, Canvas, Linen, and other Articles, Water-proof. By MM. Farrimann *and* Thilly.—[From the Bulletin of the French Society for the Encouragement of National Industry.]

Take 100 lb. of the best linseed oil; add 1½ lb. of acetate of lead, 1½ lb. of calcined umber, 1½ lb. of white lead, and 1½ lb. of very finely-powdered pumice-stone. These solid substances, well ground and mixed together, must be boiled in the oil for ten hours, over a moderate fire, to prevent the oil from burning. This varnish should be of such a consistence, that, when mixed with a third part of its weight of pipe-clay, it will be as thick as treacle. It is left to settle eight days, and is then passed through a lawn sieve. The next process is, to grind, in a solution of strong and clear glue, as much pipe-clay as amounts in weight to the tenth part of the oil employed, and to mix it to the consistence of ointment; adding the varnish by degrees, and stirring it well with a wooden spatula. This varnish must be repeatedly stirred, till it becomes perfectly fluid; and then the desired tint is given by adding a fourth part of the colour, ground in oil.

The linen must be stretched upon a wooden frame; and the composition applied upon it, with a large spatula three inches broad and nine inches long. The frame is then inverted, and the operation repeated upon the other side of the cloth. It is then left to dry for a week, and separated from the frame for use.

This cloth may be used for riding-hoods, covers for carriages, &c. &c.

For leather and skins the same composition is used; but to give the surface a smooth and brilliant appearance, the following varnish is employed. Take 5 lbs. of the oil varnish, and an equal weight of well-clarified resin; boil them together until the resin is dissolved; then add 2 lbs. of oil of turpentine, having the colour to be given to the varnish ground with it, and passed through a lawn sieve. This varnish is to be applied with a brush. When the varnish is thoroughly dry, it must be rubbed over with a pumice-stone and water, and be then washed clean. Two or three coats of varnish being then applied, and each coat suffered to dry for two or three days, is sufficient to produce a brilliancy equal to that of the Japan lacker.

RANK OF ARTIZANS AMONG THE FLORENTINES.

It may be interesting to many of my brother mechanics to know, that "in the year 1266, the people of Florence (at that time the most polished and enlightened city of Europe) to resist the influence of the aristocracy, were divided into seven separate classes, termed 'Arti Maggiori' (chief professions), each having a consul or leader. Among these were enumerated judges and notaries, manufacturers of wool, traders in foreign merchandize, brokers, physicians, mercers, silk and fur dealers, &c. &c. &c. All those entitled to rank in the 'Arti Maggiori' were, at that period, considered as gentlemen."—(*Memoirs of Benvenuto Cellini.*)

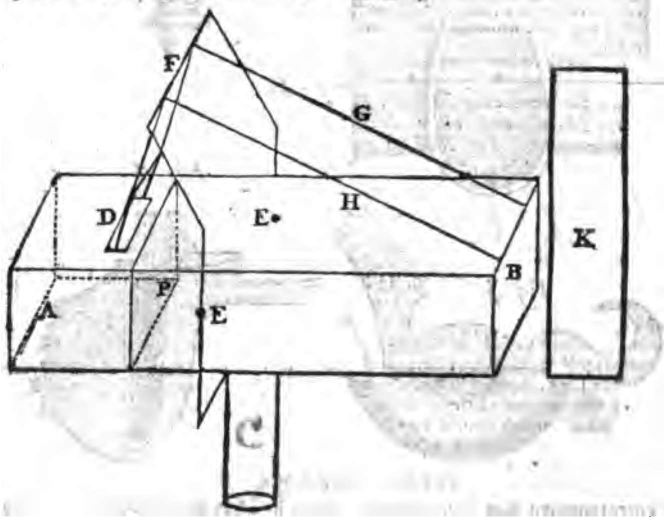
This shows how much that wise and polished people the Florentines esteemed the "arts," since a judge ranked with a manufacturer.

A Carpenter.

THE SHOE-MAKERS' SELF-ACTING LAMP.

Red Lion-street, Clerkenwell,
April 20, 1824.

Gentlemen;—It is with feelings of considerable pleasure that I sit down to give Philophos (p. 84, Vol. II) a description of the Self-acting Lamp which I had formerly stated was contrived by a very poor hard-working shoemaker, at a town in Scotland, famous for its ancient ruins and manufacture of table-cloths. Fourteen years ago the shoemaker's workshop was the common rendezvous in a winter's evening of myself and a number of other boys, who often resorted thither to hear him tell "his queerest stories;" and being blessed with a memory of considerable retentiveness, I can give a pretty exact description from memory of the lamp, though I made neither drawing nor model of it at the time. I should feel no reluctance in mentioning the name of the shoemaker, but what would it avail? He is now far beyond the reach of those who would be inclined to confer a favour upon him; for I have been informed, even since I read Philophos' article (for I made it my business to make particular inquiry) that his body now mingles with the clods of the valley, so that his posthumous fame would amount to nothing.



A B represents a cistern, made of tin-plate, about nine inches long, and about two and a half or three inches in breadth and depth; P a partition in it; A the receptacle for the oil; D the hole where the wick protrudes, and which is cased inside of A, and perforated; C a ferril, into which is placed a wooden rod, attached to a pedestal for supporting the whole. C E F, a slender iron frame, upon which the cistern is suspended by the pivots E E, the top part F being cylindrical, and revolving on centres. G and H are two fine flexible wires which are hooked to a piece of stout wire, made in the form of K, round which a piece of cotton cloth is wrapped. This last is put into the hole at D, and a part of the uncovered wire projects from the cistern, about two or three inches. Now, let the cistern be filled with oil, and nicely poised by weights at B; from the nature of the mechanism, then it is evident, that as the oil is consumed, B will preponderate; and since it moves over a greater space than that at D, the wick will be gradually drawn from the oil cistern A, and at the same time the oil will always (from the inclination of the cistern) continue at the surface of the hole D, so that the capillary action of the cotton can never languish for a fresh supply.

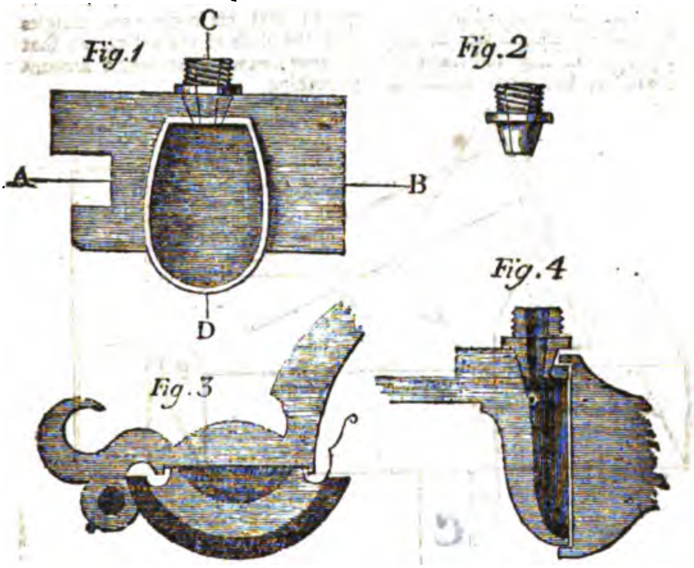
Such is the rude and simple form of the lamp, and its principles I am inclined to think are the very same as that which has been laid before the Society of Arts, although perhaps devoid of all its gaudy and attractive decorations.

J. Y.

P. S.—This lamp, by a very simple contrivance, might be made to indicate the divisions of time with considerable precision.

An acquaintance of mine, Mr. G.

Mitchell, overseer of the works of the New Oil Gas Company, lately established at Edinburgh, and latterly foreman to Mr. James Milne, brass-founder there, has invented a curious lamp, which he calls a Hydro-Oleum-Pneumatic Lamp. I shall endeavour to get the drawings and description from him, and send them to you for the use of your pages.



FRENCH GUN-LOCK.

A correspondent has favoured us with a description of a gun-lock which he met with in France, the superior construction of which he considers deserving of being brought under the notice of our own gunsmiths.* The preceding drawings explain in what its peculiarity consists. Fig. 1 is the plan of the pan where the touchhole is in its place; fig. 2 is a plan of the touchhole out of its place, one end of which screws into the barrel; fig. 3 is an elevation of a cut in A B, where is seen the lead that lines the hammer; fig. 4 is an elevation of the cut C D, where is also seen the lead, and the manner in which the hammer shoots over the pan.

* We have unfortunately mislaid the epistolary part of our correspondent's communication, which was cut off from the rest at the time the drawings were sent to our draughtsman; but, if we recollect rightly, it contained no material addition to the description here given.

WHITE COPPER.

We noticed at p. 38, Vol. II, a species of white copper, similar to the Chinese tutenag, which has for a considerable period been made and manufactured in Germany, and the suggestion of Mr. Kefferstein, that experiments should be instituted with the view of ascertaining whether a similar compound could not be artificially produced. A correspondent informs us that Mr. Barker, who was some time agent for the lead-mines at Leadhills, and another gentleman, made a number of trials, upwards of thirty years ago, to make the tutenag, and that they not only succeeded completely, but had several articles manufactured from it. The metal was compounded from a sort of slag found at Leadhills, and an admixture of zinc, and the only difficulty regarded the relative proportions.

WHEEL-CARRIAGES.

Bristol.

GENTLEMEN;—I have read with considerable interest the papers of E. Vialls and other correspondents on the subject of the line of draught most proper for wheel-carriages. I remember to have heard the same subject extremely well treated by the late Mr. Walker, in the course of lectures which he used to deliver in different parts of England, on Experimental Philosophy; and if a few extracts from my notes of the same, can be of any service towards the elucidation of the matter, they are very much at the service of your readers.

E. KNOX.

A horse, considered as a machine, is admirably constructed for draught or sustaining weight. His limbs form an assemblage of levers, which it would require a volume to point out. Attend, however, particularly to the formation of his shoulders: at the place where the neck rises from the chest of the horse, the shoulder-blades form the resting place of his collar or harness into a slope or inclination, and as this slope or inclination forms an angle with a perpendicular to the horizon of about 14 or 15 degrees, it is clear the line of his draught should form the same angle with the horizon —Why? Because the horse will then pull perpendicularly to the shape of his shoulder, and all parts of the shoulder will be equally pressed by the collar.

The horse, besides, considered mechanically as a lever, has in this inclined draught a manifest advantage over all obstacles opposed to it in comparison with an horizontal draught; its power is in fact doubled.

We are entitled, therefore, to conclude, that single-horse carts are preferable to teams, and that four single-horse carts will draw more than when yoked to one cart. The reason—Because, in the latter case, three of the horses must draw horizontally, and therefore in a manner inconsistent with their mechanism.

Truth of this proved by practice—The small horses of the North of England draw larger weights than the largest waggon-horses of London, and go longer stages. The small horses of Ireland will draw as a common load 15 cwt., while our best waggon-horses do not draw, on an average, more than 10 or 12 cwt.

In the case of our eight-horse waggons, at least, six out of the eight horses draw inconsistently with their mechanism, so that much exertion is misapplied; the horse's collar is also drawn against his throat, and his breathing interrupted.

In cart-teams, where the horses are not marshalled, as in waggons, one horse is standing still while another is wasting his strength in pulling him forward. One horse leans one way out of the line of draught, whilst another is leaning a contrary way; their strength, in short, is scarcely ever united.

A horse, moreover, has the *momentum* of his draught increased by having a portion of the weight on his back. Hence, low wheels are not so disadvantageous as is generally supposed; for low wheels oblige the line of draught to incline agreeably to the natural draught of the horse.

To prove that a horse should have something to lift in his draught, to give that draught its utmost momentum, Mr. W. mentioned that he had made the following experiments:—

He constructed a model of a four-wheeled carriage, whose weight was 82 ounces, the fore wheels 8¼ inches, and the hind wheels 10½ inches. This was drawn on a horizontal board by a line over a pulley; an obstacle 1⅛ inches high was placed before the fore-wheels, and the splinter-bar raised on the futchels, so as to be even with the top of the fore-wheel. The line of draught was then *horizontal*.

When things were so disposed, the weight necessary to draw the fore-wheels over the obstacle was 42 oz.

On lowering the splinter-bar, so as to make the line of draught to be from three-fourths the height or diameter of the wheel, the weight required was only 30 oz.

By lowering the splinter-bar still farther, so as to make the line of draught *from the axle*, the weight required was reduced to 24 oz.*

On changing the point of draught to a splinter-bar one inch below the axle of the fore-wheel, the weight was only 22½ oz.

It was hence to be seen, that the disadvantages of drawing from above the centre are as the sines of the respective arcs passing through the splinter-bar; and the advantage of drawing from below the centre, also as the sines of the respective arcs.

Now, as the splinter-bar, or point of draught, in most of our carriages, is placed about one-fourth the diameter of the fore-wheel above its centre, it is evident that a fortuitous pressure, equal to one-fifth of whatever weight lies upon it, is actually added to the natural weight by this unnatural situation of the point of draught.

Another course of experiments was made by Mr. Walker before several gentlemen, well versed in mechanics, on a waggon-like model, weighing about 156 lbs.; the fore-wheels four feet two inches in diameter, and the hind wheels five feet six inches, with an obstruction placed against the two fore-wheels of 6¼ inches.

When the line of draught was perfectly horizontal, or even with the top of the fore-wheels, it required to draw it over the obstruction a weight of sixty pounds.

When the direction of the line of draught made an angle with the horizon of seven degrees, by lowering the point of draught six inches below the top of the wheel, the weight required was 48 lbs.

When the end of the line of draught was lowered, till the direction of it was at an angle of 11° with the horizon, it got over the obstruction with 41 lbs.

When the end was lowered to the centre of the wheel, and the line of draught was at an angle of 15° with the horizon, the obstacle was surmounted with 33½ lbs.

When the end of the line of draught was lowered to 6¼ inches below the centre or axle, so that the angle with the horizon was 17°, it was drawn over with 30½ lbs.

When it was lowered to one foot and half an inch below the centre of the wheel, so that the angle was 18°, it was drawn over with 29 lbs.

When it was lowered to 18¼ inches below the centre (being only 6¼ inches above the road, and exactly level with the height of the obstruction), the angle 23°, the weight necessary to draw it over the obstruction was 27 lbs.

These experiments, though made upon so much larger a scale than the former, produced exactly a similar result.

A third experiment with a common chaise, when drawn by a splinter-bar as high as the top of the fore-wheels, proved that it required 80 lbs. to put it in motion; when drawn from the axle, it required only 51 lbs.

With another chaise, and the splinter-bar three-fourths of the height of the fore-wheel, the draught over an inch obstruction, required 100 lbs.; but when drawn from the axle, only 61 lbs.

With another chaise, and the splinter-bar three-fourths of the height of the fore-wheel, the draught over an inch obstacle required 119 lbs., but when drawn from the axle, only 93 lbs. So that in both cases there was one-fourth in favour of the draught from the axle.

With the same chaise, drawn up a hill rising one foot in six, with the splinter-bar one-fourth of the wheels diameter from the top, it required 168 lbs. to draw it up. But when drawn up the same hill from the axle, it only required 129 lbs.; there was, therefore, the same advantage nearly in this mode of draught uphill as on level ground.

* Which confirms so far the experiment made by Mr. Vialls' correspondent—(See p. 99, Vol. II).

DRAWING THE SEGMENT OF A CIRCLE.

Gentlemen;—Not rightly understanding the method of drawing the segment of a circle with a large radius, as described by J. Y. (p. 443, Vol. I. of your Magazine), I and several other brother tradesmen will feel obliged by a further explanation. We cannot conceive how sliding the upper board D E B in the direction B E will cause the point E to describe half the segment, as marked by the dotted line in S. Y.'s diagram. We have frequently felt the difficulty of drawing segments with a large radius, and shall feel much obliged to any of your correspondents who will inform us of any more practical method than the common one, of dividing the square of half the chord by the versed sine, adding to the quotient the versed sine, the half of which (being the radius of the whole circle, of which the required segment is a part) will give the radius required; but which, in a segment of twelve feet chord and six inches versed sine, will require a radius thirty-six feet three inches, much too large for common practical operations. A. J.

Having communicated the preceding letter to our intelligent correspondent J. Y., the following is his reply—"To A. J. I can only say, that I cannot give him a clearer view (in writing) of the method of describing a segment than that already stated at page 443, without being *very* circumlocutory; but if he and his companions live in town, or even within ten miles of it, I shall with great cheerfulness travel that distance to show it more clearly to him. He has only to say where I can see him or them." If A. J. will leave his address for J. Y. at 24, Paternoster-row, it will be communicated to him.

POWER OF STEAM-ENGINES.

As I was the person who wrote the article (p. 229, Vol. I) on the Power of Steam-Engines, which has been since practically illustrated (an illustration which my paper certainly wanted) by William Andrews, but afterwards found fault with by S. Y., I beg to observe, that ample authority for both articles may be found in that excellent work, "Gregory's Mechanics," Vol. II. third edition. Should S. Y. be able to give us a more correct view of the subject, I shall be happy to see it. He may, perhaps, however, discover that he has got an *old* engineer to deal with. It surely requires caution to contradict the statements of such illustrious men as Watt, Smeaton, Desaguilier, Gregory, and Brewster. J. Y.

ECONOMICAL OIL BOTTLE.

GENTLEMEN;—I beg leave, through the medium of your Magazine, to make public an improvement, which, although it regards a greasy, trifling article, yet is of very considerable importance, as it tends to prevent waste, to save time, and to economize an article very generally used by mechanics. It is an "Economical Oil Bottle," of which the following is a drawing—

Procure a small bottle (I use one of those which are sold by perfumers, containing oil for ladies' curls, &c.), fit a cork to it, get a quill or tube of any kind, burn a hole through the cork, and insert the tube, and let it be air-tight. When the cork with the tube therein is inserted in the bottle, let the tube just clear the bottom of the bottle, and let the upper and project, say a quarter of an inch, above the cork. Put some oil in the bottle, say to ½ an inch in height. Insert the cork, and the oil will be raised in the tube by the compression of the air in the bottle to three or four times the height of the oil in the bottle. Put your fore-finger on the tube, and with your thumb and middle finger lift out the cork and tube, keeping your fore finger on the tube until you convey it to where you wish it applied, when, by raising your fore finger, the pressure of the atmospheric air will force out a stream in proportion to the size of your tube. When enough is discharged for your purpose, you have only to press your fore finger on the tube. Should but a small quantity be required, take out the cork without putting your finger on the tube, and when raised, place your finger on the tube. You may then carry it to any distance without its dropping, and by touching the parts of any work you wish oiled, make use of it in very small quantities. Should you want still less, lift your cork as in the last instance, and in taking it out, hold the bottom of the tube against the inside of the neck of the bottle, and you will nearly extract the whole of the remainder drop by drop. If a stopper is kept in the top of the tube, though the bottle should be thrown down or even turned bottom upwards for a short time, the oil will not run out.

If, instead of inserting a tube of equal diameter in the cork, you insert a taper one, the lower hole being sufficiently large to admit a small pin, and the upper one to admit an ordinary sized pea; by the same action, oils and other fluids will charge it; and when the finger is removed from the top, oils will be discharged by drops only; but volatiles or æther, &c. will discharge more rapidly, unless held when taken from the bottle in a horizontal position, when they may be dropped to the greatest nicety. Volatiles also will require the small hole at the lower end of the tube to be smaller than for oils, and when not in use, a cork may be inserted in the upper end of the tube to prevent their escape. Mercury from its density will not act well; but if you fill, or partly fill, a taper tube with mercury, and close the big end, then by jerking the tube, small globules will escape.

JAMIESON'S CARRIAGE.

2, Clifford-street, Blackfriars-road, April 19, 1824.

GENTLEMEN;—I regret that I did not sufficiently describe the drawing of a new carriage, which I submitted for your consideration; but I did conceive, that from the simplicity of its construction, and absence of complicated machinery, it would have been understood by every intelligent mechanic. However, I find this is not the case, by certain questions put to me by R. W., in your Magazine, for the 17th of April. He asks, "How that long lever is managed," and the use of the standard which the lever rests in? I beg to inform him, that the standard which the lever rests in, relieves the rider from the labour of bearing the weight of the lever with his hands, and materially assists in guiding its direction. He next inquires, whether the acute angle which the lever makes with the carriage-pole be its fulcrum? I answer, Yes. With regard to the third question, namely, Whether the angles have moveable centres? I have this to say, that I did not intend the angle made by the carriage-pole should have any moveable centre; but from the extreme end of the carriage-pole, a strap connects it with the lever, which allows more freedom for the lever to act with additional power.

EDWARD JAMIESON.

READ'S IMPROVED SYRINGE.

30, Bridge-house-place, Newington-Causeway.

GENTLEMEN;—In the descriptions of the plate representing my syringe, which you were pleased to give in your last Number, the reference to the bent lateral tube near the mouth of the instrument was finished. Now this tube not only occupies a place of some importance in the specification of my patent, but is a material agent in the action of the syringe, and is, besides, a most essential mark of distinction, both in form and utility, between it and other syringes of every denomination. This tube is for the purpose of admitting the passage of air into and out of the cylinder during the alternate motions of the piston, thereby considerably facilitating its action, which would be greatly impeded, and must require much additional force could the atmosphere be admitted only through the opening in which the piston slides. I need not explain the pneumatic principle upon which this tube is necessary to the instrument, but remain, Gentlemen,

Your humble, obedient servant,
J. Read.

MENDHAM'S IMPROVED METRONOME NOT NEW.

Birmingham, April 17, 1824.

Gentlemen;—In your Magazine of April 10, p. 71, there is an article in which S. Mendham, referring to Mr. Mealzel's Patent Metronome, says, he has taken the trouble to invent a machine upon improved principles. Now, Gentlemen, I can assure you there is not any thing new in this; for Mr. W. Heaton, a man well known in the musical circles of Birmingham, has a machine made by himself more than six years ago, which is upon the same principle as that Mr. Mendham speaks of. It is alterable to any number of beats in a minute required in any piece of music, and also by means of six wheels (fixed upon the axis of the wheel which moves the pendulum) moves a small lever, which gives the number of beats in every bar. The various times this machine gives is 1, 2, 3, 4, 6, 8, and 12 beats in a bar; the number wanted is indicated by a dial and finger. Now, Gentlemen, it being possible that Mr. Mendham may have either seen or heard of this machine, as it has been seen by some of the nobility, and many of the musical profession in this neighbourhood and London, and highly approved, it will be but doing justice between man and man to let it be known through your interesting Magazine to whom the priority of invention really belongs.—I am yours,

J. H. B.

ANSWERS TO INQUIRIES.

GLAZING EARTHENWARE.

Feb. 6, 1824.

Gentlemen;—I think your correspondent, "A Searcher," incorrect in saying (p. 366, Vol. I), "I recollect reading in the Courier newspaper, I think about two years since, that a gentleman in the North of England had received (if I mistake not) the personal thanks of his Majesty, and a medal, for the discovery of a method of glazing the common sorts of earthenware without the use of lead."

The Society of Arts, in 1822, offered a premium of their large gold medal, and awarded the same to J. Meigh, esq. of Shelton, Staffordshire, for a glaze for vessels of common red earthenware, not prejudicial to the health of those who make use of them. Specimens of the ware, so glazed, and of the glaze itself, as well as of the ingredients of which it is composed, are placed in the Repository of the Society. See Volume 40, of the Transactions of the Society of Arts, in which is detailed the ingredients of the above glaze, and also an improved composition for the ware itself.*

I am, Gentlemen,
Your obedient servant,
G. C.

Phosphorescent Appearances—How to prepare Solar Phosphorus.

Woolwich.

Gentlemen;—Being a constant reader, and no less constant admirer, of your Magazine, I frequently observe with pleasure the spirit of investigation and research inculcated among your readers and correspondents, by the repeated inquiries on many interesting and important subjects. I would observe (in answer to the inquiry of X. Y. No. 20—"How can the phosphorescent appearance caused by rubbing together two pieces of sugar, be philosophically accounted for?") that those philosophers who maintain light to be an emanation of particles

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* Both of which are copied for early insertion in the Mechanic's Magazine.—Edit.

of extreme minuteness from all luminous bodies, account for phosphorescence by supposing the substances in which this phenomenon exists, to absorb light under some circumstances, and under others to emit it. Now, some substances appear to exert a much stronger affinity to it than others; for some emit it spontaneously, as the solar phosphori of Canton and Baldwin, among insects, rotten wood, the bones of fishes, and many other substances; others require the repulsive agency of caloric, and thus retain it till the temperature is raised, of which class are fluor spar, different marbles, feld spar, many gems, and various fossils. Other substances, again, retain it still more powerfully, and do not emit it till friction is applied: to this class belong quartz, the tremolite, agate, rock crystal, and sugar, with respect to which X. Y. makes inquiry. The cause of *friction* producing this appearance, I conceive to be the separation of the particles, which fly off and fill the surrounding atmosphere; the temperature is at the same time elevated, by which repulsion is caused; the light is separated, flies off, and if there were a sufficient quantity, we should, no doubt, find it subject to all the laws of light, radiated from luminous bodies. I shall conclude these observations, by giving the mode of preparing the most powerful solar phosphorus, which may be of service to some of your readers. Cleanse oyster-shells by well washing, expose them to a red heat for half an hour, separate the purest part, and put it into a crucible (a small old flower-pot answers very well) in alternate layers, with sulphur, till almost full; expose the vessel to a red heat for one hour at least; when cold, break the mass, and separate the whitest parts for use. When inclosed in a bottle, the figures of a watch may be distinguished by its light.

Your obedient servant,

J. ALWIN.

INQUIRIES.

No. 10.—STEAM-ENGINE CHIMNEYS.

I shall feel obliged if any of your readers will favour me, as soon as convenient, with their opinion upon the following plan for a chimney for a 24-horse steam-engine:—I propose to build it 120 feet high, square on the outside, and regularly tapered from the bottom to the top, the orifice round, and 27 inches in diameter the whole height. It has been suggested to me that the orifice ought to be wider at the bottom, say 40 inches; but this is not my own opinion. I take it for granted that a chimney round in the inside is superior to a square one, on the same principle that a gun-barrel is better round than square, the force being more concentrated. I should wish to know if a chimney of the above description will insure me a good draught; whether a chimney round in the inside is not better than a square one of the same diameter, and also, if such a chimney is of the proper proportion for such an engine? It is a well-known fact, that a great number of steam-engines are not working up to their power for want of proper chimneys. Perhaps some of your readers will have the goodness to furnish a scale *pro bono publico*. I. G. H.

Bingley, Yorkshire.

No. 11.—FRICTION OF INDIAN RUBBER ON PAPER.

GENTLEMEN;—Having occasion to dry a piece of paper at a coal fire, and afterwards to apply it briskly with Indian rubber, I found this process to give to it an adhesive quality, which it did not previously possess; that it retained this quality for several minutes, and that neither the heat from the fire nor that communicated by friction were effective singly to produce this property. I shall be particularly obliged if by your insertion of this, any of your intelligent correspondents may be induced to favour me with a particular explanation as to the philosophical principles upon which this is founded. R. C.

P. S.—Subsequent trials prove to me that parchment retains this property longer than paper, and especially if rubbed upon a heated board, when it will maintain itself for twenty minutes and upwards, not only laterally, as against a wainscot, but even suspended to a ceiling.

[We have a similar inquiry from Neb Dirpe.—EDIT.]

No. 12.—THE FUEL BEST FOR SMOKING HAMS, &c.

Mrs. D. begs that I would request from some one of your kind readers an answer to the following query; and as contributing to domestic comforts, I shall feel obliged by its insertion. What is the best method and *material* of fuel to be used for smoking hams, beef, &c.

calculated for family purposes and kitchen practice?

Yours very obediently,

NED DIAPE.

No. 13.—CRANKS IN STEAM-ENGINES.

Leaving out of the question every thing which is not connected with power, is the crank an evil in the steam-engine? In other words, provided we could make the steam exert the whole of its force on the extremity of an invariable lever, during a revolution of the fly-wheel, would more angular velocity be generated in a given time than according to the present construction?

PRESERVING EGGS.

In 1820, a tradesman of Paris asked permission of the prefect of police to sell, in the market, eggs that had been preserved a year in a composition, of which he kept the secret. More than 30,000 of these eggs were sold in the open market without any complaint being made, or any notice taken of them, when the Board of Health thought proper to examine them. They were found to be perfectly fresh, and could only be distinguished from others by a pulverous stratum of carbonate of lime, remarked by M. Cadet to be on the egg-shell. This induced him to make a series of experiments, which ended in his discovering that they were preserved in highly saturated lime-water. M. Cadet suggests adding a little saturated muriate of lime, but gives no reason. They may also be preserved by immersing them twenty seconds in boiling water, and then keeping them well-dried in fine sifted ashes; but this will give them a greyish green colour. The method of preserving them in lime-water has been long the practice of Italy; they may be kept thus for two years. This useful mode is well known in many parts of England, and cannot be too much recommended.

NEW PATENTS.

To John Heathcoat, of Tiverton, for certain improvements in machines now in use for the manufacture of lace, commonly called bobbin-net; and a new method of manufacturing certain parts of such machines.—Dated March 9, 1824—six months.

To William Darker Mosley, of the parish of Radford, in the county of Nottingham, lace-manufacturer; for certain improvements in the making and working of machines used in the manufacture of lace, commonly called bobbin-net.—Dated March 10, 1824—6 months.

To William Morley, of Nottingham, lace-manufacturer; for various improvements in machines, or machinery, now in use for the making lace or net, commonly known by the name of bobbin-net.—Dated March 15, 1824—6 months.

To James Rogers, of Marlborough, surveyor; for an improved method, or an improved instrument or instruments, for determining or ascertaining the cubic contents of standing timber.—Dated March 20, 1824—six months.

TO CORRESPONDENTS.

A Friend * will find the article he has favoured us with already inserted, p. 91, Vol. I.

A "Well-wisher to Discovery," who has formed some new opinions as to the motions of the earth, and the cause of tides, which he promises ere long to lay before the public, wishes us in the mean while to apprize Captain Parry, that he conceives "the ebbing and flowing of the tides is of such a nature, as to leave no water at all at either of the poles of the earth!" Can Captain Parry do less after this intimation, than apply at the Admiralty for new instructions?

"Soi-disant Wiseman" is certainly right in supposing, that when a vessel is said to be of so many tons, the reference is to her capacity, or the number of tons she will carry.

"Beer Monopoly," if possible, in our next.

A Drawing of the Carriage alluded to by J. G. is in the hands of our engraver.

Communications received from "One who enjoys his friend most when the smoke rises freely up the chimney."—Arch. Hamilton Rowan, esq.—Mr. T. Gray—T. M. B.—Protector—A. Mechanic—W. H.—Philos—Mr. Gregory—Omega—Petition of Suction (in whose case we sympathize strongly)—Nathan Short—An Inquirer.

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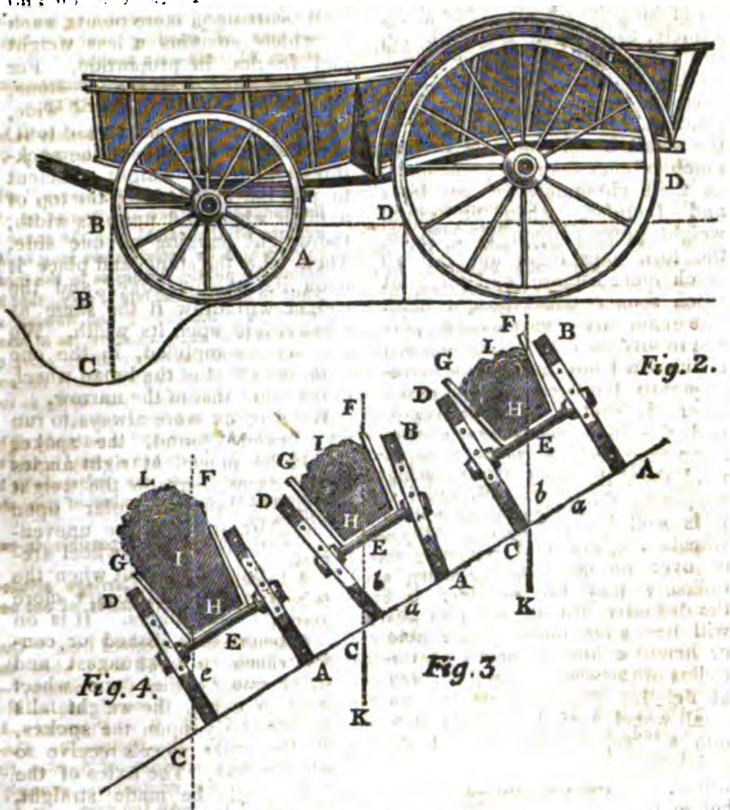
Never came reformation in a flood
With such a heady current.—*Shakspeare.*

No. 38.] SATURDAY, MAY 15, 1824. [Price 3d.

Fig. 1.



CARRIAGE-WHEELS.

Long Acre, March 9, 1824.

GENTLEMEN;—As a subscriber and constant reader of your valuable little miscellany, allow me to have the pleasure of contributing my mite upon the subject so ably taken up by your correspondent *E. Vialls*, namely, that of wheel-carriages. It has long been a matter of astonishment to me, that no improvement has been introduced upon the general plan. In all four-wheeled carriages the fore-wheels are made much smaller than the hind ones, while it is past all doubt that a carriage would go much easier if the fore-wheels were as large as the hind ones, and even higher, because they would sink less into the hollows in the road, and be much easier drawn out. The only advantage gained by making the fore-wheels smallest, is, that they enable the driver to turn a corner more sharply. Carmen and coachmen, indeed, give another reason for making the wheels of two sizes, namely, that when they are so, the larger wheels help to push on the smaller. This idea, however, is too absurd to merit refutation. It is perfectly clear that the small wheels must revolve as much oftener than the great ones, as their circumferences are less; and therefore when an equal weight presses upon both axles, the fore ones must undergo so much more friction, and wear out much sooner than those behind. The generality of carmen, too, persist in loading their waggons much heavier in front than behind, consequently the friction is increased where it should be diminished, and the fore-wheels are at the same time pressed deeper into the road than the hind ones. Even supposing the loading to be equal, it is well known that the fore-wheels are drawn out of a hole or over an obstacle with more difficulty than the others. For the difficulty with an equal weight will be as the depth of the hole or height of the obstacle is to the radius of the wheel, as represented at fig. 1. For example, if the small wheel A of the waggon sink into a hole, the depth of B C, which is equal to the radius of the wheel, and the waggon be drawn horizontally, the point B of the fore-wheel must be pulled against the edge of the hole, and therefore the horses will not be able to pull it out unless the ground give way; on the contrary, should the hind wheel D sink into the hole, it sinks much less in proportion to its radius, and the point D of the large wheel will not be pulled directly, but obliquely against the edge of the hole, and thus be more easily drawn out.

The carmen used to complain greatly of the Broad-wheel act. A broad wheel, they observed, must touch a greater space of ground than a narrow one, by which more friction will be caused, and more horses rendered necessary. They did not consider that the weight of the waggon and load bears upon more points, each of which sustains a less weight and friction in proportion. For instance, take a piece of stone, about 6 or 8 inches long, 4 wide, and 2 thick; tie a packthread to it, and to the other end of the packthread fasten a weight sufficient to pull the stone along the top of a table when laid upon its width, the weight hanging off one side. Then take the stone, and place it upon its narrow edge, and the weight will draw it the same as when it laid upon its width. We see here exemplified, in the one case, the effect of the broad wheel, in the other that of the narrow.

If a waggon were always to run upon even ground, the spokes should be placed at right angles to the axles, because the weight would be perpendicular upon them; but owing to the unevenness of the road, one wheel frequently sinks into a rut when the others do not, and bears more weight than the others. It is on this account that dished or concave wheels are strongest and best, because when one wheel sinks into a rut, the weight falls perpendicularly upon the spokes, while the other wheels receive so much the less. The axles of the wheels should be made straight, so that the rims may run parallel with each other, which enables them to run much easier. The general method, however, of making axles, is to incline them downwards at the ends, and by the wheels being thus brought closer together at the bottom than at the top, they not only drag sideways but are apt to upset the carriage when they fall into a rut, or when the carriage runs upon a road which has one side lower than the other. We may make this clearer by one or two examples. A B and C D, fig. 2, represent the great wheels parallel to each other on their straight axles E; and F and G the body of the waggon loaded with heavy goods from H to I. Now, as the waggon goes on in the oblique line A C, the centre of gravity of the waggon and load will be at H; and the line of direction H K falling within the wheel C D, it is clear that the waggon cannot overset; but if the wheels are closer to each other next the ground, as at fig. 3, and the waggon be loaded, as before, the line of direction falls without the wheel C D, and the waggon tumbles over. When the waggon is loaded with very heavy goods, as lead, iron, &c. it will travel safely along an oblique road, while the center of gravity is at H, and the line of direction H K falls within the wheels; but if loaded high with light goods from H to I, as fig. 4, the center of gravity is raised from H to I which throws the line of direction I e without the lowest edge of the wheel C D, and the load overturns the waggon.

If the advantage of turning a corner be enhanced by the fore-wheels being smaller than the hind ones, it is more than counteracted by the axle being below the breast of the horse. The horses, besides having the load to draw, have also to bear the weight, which tires them sooner than if they drew upon a level with the fore-axles. It is owing to this reason we find draught-horses not fit for riding: it is plain, therefore, that the axle should be upon a level with the horse's breast.

I am, Gentlemen,
Your obedient servant,
J. R.

EMIGRATION OF ARTIZANS.

Extracts from the Evidence.

(Continued from p. 135.)

Mr. Osler, of Birmingham, further examined—

Are you aware in what state the tool manufactory is in France, compared with that in England?—I apprehend, generally speaking, we make much better tools in England.

Do you know any thing which prevents their having all our English tools, if they chose to order them?—It would be very difficult indeed to prevent their having any; but I conceive it rests with the legislature to oppose very great obstacles indeed to the exportation of considerable quantities.

The question speaks of the law as it now is; do you know whether tools of the nature now mentioned might be ordered by a Frenchman of a manufacturer in England, as well as by a person in Birmingham?—They might be ordered, but I apprehend some difficulties would be found in exporting them, though not so many as I think desirable.

Is there any difficulty in exporting tools?—Yes; many tool manufacturers of respectability would not export a tool which they knew to be prohibited.

Do you know that those tools are prohibited?—I believe that watch-makers tools were not included in the list, and that reminds me of a circumstance I should have mentioned to the Committee before. Among other impediments which exist to the free exportation of the pressing and cutting tools I have just alluded to, it should be remembered, that a foreign manufacturer, who has never seen that article made here, actually does not know what kind of tools to order.

Supposing he has an Englishman there who has seen it made?—He would give him, no doubt, sufficient directions.

Do you not know that that is the case in every part of the continent almost?—Yes; but I think that an additional reason for keeping those individuals at home.

Can you keep them?—We cannot prevent crime, but we may greatly diminish its extent by preventive laws; I believe that existing regulations prevent many from emigrating, and that many more would emigrate, if those laws did not exist.

Did you ever speak to any artizan who had been abroad, working at any manufactory?—No; I was to have seen two or three the day before I left home, but my engagements did not permit it.

Do you know whether the laws now existing with respect to artizans prevent many returning to this country who would return if there were no such laws existing?—I have been told there are impediments to their return.

If the laws are impediments to their return, do you not consider it would be impolitic to remove them?—That leads to an inquiry into many circumstances; I should then consider in what degree we should probably suffer from the removal of impediments to the emigration of artizans, or derive benefit from the return of those who had emigrated, and decide according to the apparent balance of advantage. I should have observed before, that watch makers' tools were once extensively exported from Birmingham, and that the demand has now ceased, the continental manufacturers being able to make them themselves.

Was not the watch-trade in a state of great perfection on the continent, before it was so in England?—I doubt if they make as good watches now as they do on the continent; but undoubtedly watches are made abroad in very large quantities.

Are the Committee to understand, that in one of your former answers you stated, that nineteen twentieths of the articles manufactured in Birmingham would, if every facility was given to the exportation of artizans and machinery, be competed with abroad?—I believe that to be the fact.

If our artizans have much to impart to foreigners, do not you think that foreigners have also much to communicate to us?—That is an important question, and not to be answered on the instant. No doubt they have much to communicate to us; but I believe by exchanging all our knowledge on either side, we should be the greatest losers.

Do not you think that if our artizans were permitted freely to go to France, they would bring back some secrets of the French manufactures, which might be advantageously applied to our own?—I dare not answer that question in the negative; but I do not think that they would to any great extent. The French certainly excel us in the manufacture of coloured glass; they make many colours which we cannot, and even if we were acquainted with their processes, I am informed that the excise regulations would interfere with our employing them.

Under the most free intercourse of French and English artizans, would not each country excel the other in some articles of manufacture?—No doubt.

Would not our superiority be still maintained in articles of extensive demand, and the French superiority on fine articles, or where much hard labour was employed?—I really do not think so; but when I express my persuasion that the French may be rendered capable of competing with us in every branch of manufacture, I must be considered as anticipating the lapse of a very considerable space of time. I am thoroughly persuaded the fact is as I have stated at present; when I entertain any doubt upon the subject, I must be considered as speaking to the lapse of a considerable time; my idea is, that in every species of manufacture they would be able to compete with us in every branch.

Do you conceive that they have an equally skilful body of mechanics on the continent with those you have at Birmingham?—In articles which they have been accustomed to manufacture, their artizans are as skilful as our own.

Do you conceive they have the same persevering industry?—I do not consider myself competent to form any conclusive opinion on that point.

Are you aware that in articles of the description of those manufactured at Birmingham, it is considered as a recommendation on the continent that they have come from England?—I am not aware that it is so with respect to articles in the toy business; but I dare say that it is with respect to buttons, and heavier articles.

Do you happen to know that the foreign manufacturers excel us very much in gilding?—Yes.

Do you happen to know whether any persons at Birmingham, or elsewhere, have endeavoured to arrive at that knowledge which they have?—I believe they have.

Do you happen to know whether they have been successful in their efforts to arrive at it?—I have seen an article within the last month at Birmingham, that made a very near approach to theirs.

Was that knowledge acquired from France or elsewhere?—I cannot say.

Would not the free intercourse of artizans enable the Birmingham manufacturers to attain that?—In all probability it would. There are some beads occasionally brought into this country; amongst them are beads of uncommon beauty, and at a remarkably low price. I am extremely desirous of learning the mode by which that appearance is given to the bead on the table; I cannot conceive how the shape and superficial pattern is given to the French beads I have produced; and I should think the time and expense of a journey to any part of the continent very well bestowed, if it would enable me to learn that mode of working. But a very intelligent lady, who visited our manufactory some little time since, after politely expressing her approbation of what she had seen, inquired if we could make such and such articles, mentioning beads of the description to which I allude. Being answered in the negative, she said they were made in great quantities on the continent; and that she had visited some of the foreign bead manufactories. She then described, in the most accurate manner, every part of the process, up to the point at which the appearance which I have pointed out was given; but "that," she observed, "was done in a workshop, to which strangers had no access." From this I infer, that foreign manufacturers are as jealous of their little secrets as ourselves; and that the *exchange* of advantages, which I should be heartily glad to see, is not very likely to take place.

If there were free intercourse between the two countries, would you be ready to meet them? I am not prepared to go that length without further consideration.

Do you know whether artizans are prohibited by French law from coming here?—I am informed they are.

Does it not appear to you, that in your particular trade, where the niceties of the art lies in the hands of a very few persons, it would be much easier at all times to transfer knowledge to France, than it would be in those trades where it would be necessary to have a large number of workmen in one manufactory to perfect an article?—Certainly.

In those trades where a great many men are required, it appears that a great many men have been carried over to France, when the French capitalists wanted them; under the present laws, if the French capitalists wanted men in your trade, do not you think they would be able to get them?—I think there would be very considerable difficulty in getting any particular workman. I misunderstood the former question. "By transferring knowledge," I supposed was meant to convey a good description of the processes; and it is evidently much easier to transfer the knowledge of what is done by one or two men, than of that in which a great variety of hands are employed. But if I am asked, do I think these two or three persons, in whom a good deal of the secret of our trade rests, could be easily transferred to France, I should at once say No; that considerable difficulty would be found in doing so.

As in those trades, for instance machine making, many men have been carried over to France when the French capitalists wanted them; under the present law, do you not think, if a French capitalist wanted the men in your trade, he would be able to get them?—There is a wide difference between a man being able *per fas aut nefas* to get a man, if he lent his energies to that object, and encouraging men to go of their own accord.

Is the Committee to understand, that in the manufacture respecting which you have given evidence, the advantage of the English manufacturer is derived less from the minute subdivision of labour than in other branches of our manufacture, respecting which evidence has been given?—I feel very great difficulty in answering that question, for the division of labour in Birmingham is carried to a very great extent indeed.

From what you have heard, is there an equal subdivision of labour in your articles as on some others?—I should think not, certainly; but it is still very considerable.

It has been stated, that one very great advantage the English possess, is in the extraordinary subdivision of labour in the manufacture of the machines; you have something of the same kind?—Yes; the subdivision in making the simplest toy, is, for the most part, considerable. I should conceive, that on the continent they have not at present the means of subdividing labour to the same extent. All the French toys which I have seen may be made by a smaller number of hands than those usually made in England.

You do not believe that there is the great subdivision of labour in the French manufacture as in our own?—I do not.

Do you suppose it possible that the labour of English artizans abroad will continue to maintain its present value?—Certainly not.

Will not that be a discouragement for English artizans to go abroad?—When that time comes, it will; but that time will not come before a sufficient quantity of skill is imparted to the native population to enable them to meet us in the market with lower prices.

(*To be continued.*)

FELLING AND SEASONING OAK TIMBER.

Gentlemen;—As it must be acknowledged that every thing tending to improve the art of ship-building, either in the theory or practice, is of primary importance in a maritime country, I have ventured to send a few of my ideas on the subject of felling and seasoning oak timber: if they should not prove founded on a just view of the matter, they will, perhaps, elicit from some of your correspondents information that I have no doubt will prove valuable to many of your readers.

1st. Oak timber is generally felled for naval purposes about May, when the sap is rising in the tree; and this time is chosen on account of the bark stripping easier. This is very injudicious, however, as regards the timber; for the capillary tubes being full of moisture, the tree contains a greater quantity than would be the case if felled in the winter, which is the time I should recommend, and which, some years ago, was the practice. I believe that when winter-felled timber was used for naval purposes, very little, if any thing, was ever heard about the dry-rot. It is my opinion, that winter-felled timber is of a better texture than spring-felled, as the vessels are not distended; and the cold causes a contraction of the fibres, which in the Spring are dilated with the heat and sap. Now, my idea of one cause of the dry-rot is this,—that in spring-felled timber, the moisture it contains, when evaporated, leaves a secretion in the vessels, which, when it meets with a peculiar state of atmosphere, undergoes a fermentation, and causes ultimately a decomposition of the timber. Another thing which I think has tended much to hasten the decay of our ships, has been the indiscriminate use of foreign timber, particularly Quebec oak, which has been used in his Majesty's dock-yards for all purposes on board of ships where a straight timber was applicable. Now, it has struck me several times, whether by thus bringing timber of different species and countries (for they have likewise used oak from the Adriatic) in contact with each other, a chemical action may not arise from the difference in the juices of the timber, favourable to decomposition, or what we call the dry-rot. I think it probable some such action might take place; but I am not chemist enough to follow up experiments on this subject, nor have I either time or opportunity.

2nd. The seasoning of oak timber appears to me to be egregiously wrong, and attended with great labour and waste of time; I shall in this instance more particularly allude to the King's yards, as being on a large scale, and presenting more cases in point. When oak timber is received at any of them, it is generally in a seeded state (except what comes from the King's forests), and is stacked in large quantities till wanted for use. Now, I cannot see any reason why the greatest part of it should not be converted into timbers, beams, &c. in the forest, which would not only be a saving in land and water-carriage, &c. but when the timbers were put in frame, they would be better seasoned than by the present method. There is also one thing I would wish to remark here, though not connected with the dry-rot, yet deserving of notice. That as many a piece of valuable compass timber is spoiled for particular purposes, by taking off so much in the siding of the piece, as will give the plane equal to the siding, with 1-8th added thereto: now if a convertor was on the spot, he might save many a piece of timber of this kind, by having it sided down to what he wants, and not to what the contract obliges the contractor to do. This plan of converting in the forests has been followed by the French; and it seems to be founded in reason, that there is no occasion for dragging about offal timber at a great expense of carriage, &c. and which offal wood might be sold in the forests when the season was over. If, in objection to this plan, it should be urged, that a mould loft cannot be carried to every forest, let all the straight work be cut there, the scantlings of which might be carried in the pocket. Were only this to be done, there would be a great saving, and the timber better seasoned. NAUTICUS.

P. S.—Since the above has been written, I have seen in the Mechanic's Magazine, No. 24, some remarks on the dry-rot by Mr. Pasley, and it is a singular coincidence that we should both have ascribed the dry rot to the *same cause*, viz. the aqueous matter contained in the timber, although we differ in the manner of its acting on the timber, he ascribing the effect produced to the decomposition of the water, and I to some matter which is held in solution in it, and on evaporation, depositing it in the capillary tubes of the timber, and causing the decomposition of it, when it meets with an atmosphere congenial to it.

BRIEF RULE TO CALCULATE THE NUMBER OF ALE GALLONS CONTAINED IN ENGINE-PUMPS, OR CYLINDRICAL PIPES.

Square the diameter of the cylinder in inches, cut off the right-hand figure; the remaining figures shew the number of ale gallons in a yard length of that cylinder. As this rule gives only one gallon too little in three hundred and seventy-nine, it may be used to advantage in most practical cases. W. A.

FAMILY CARRIAGE.

(For the Mechanic's Magazine).

GENTLEMEN;—Give me leave to describe a one-horse carriage, having the accommodation of the common car, without its cumbrousness, and the lightness of the gig, without its narrowness of dimensions, which I have just had made, and an account of which may possibly enable masters of small families, like myself, to enjoy the comfort of making their children the companions of their little excursions.

Suppose the ordinary gig, or sitting part, mounted upon the fore-part of the ordinary budget, or square boot. That part of the upper face, or lid of the boot, which is behind this sitting part, is made to *slide back* till it overhangs the end or door eight inches. Consequently a vacancy to that extent is left between it and that part of the lid upon which this sitting part is fastened. In that vacancy (that is, in fact, in the box or budget), hang the legs of the children, two of whom very conveniently sit behind the driver, facing the same way as himself. They are kept safely in their seat by three rails, one on each side, and one at the back, fastened to the sliding-lid with screw-pins. To get them in or out, this lid is pivoted with an iron pin and nut, into the upper face of one side of the boot, and upon being pulled by the handle, on the opposite side of the lid, moves in the segment of a circle, with the door under it, which is moved at the same time, and leaves a clear ingress and egress.

To make it a *back-to-back* gig, or car (call it which you will), it is only necessary to take off the back rail, slide the after half of the lid forward again, and there pin it; or the whole of the after rail may be taken away, and then there remains only a common gig.

Every thing is kept steadily and safely in its place by thumb-screws nutted, and on the opening side, by a hook and eye, instead of a handle, and the whole is moved or changed in a few minutes.

I will merely add to all this, that the carriage is a very light one.

I am, Gentlemen,
Faithfully yours,
AN INQUIRER.

SQUARING THE CIRCLE.

GENTLEMEN;—A further allusion made in one of your late Numbers to the Practical Mechanic's supposed method of squaring the circle, namely, by taking any flexible circumference of a circle, say a line of lead or string, and setting it up in an exact square (unless I misunderstand his meaning), suggests to me to make the observation, that the same outline or boundary arranged circularly, or in any other possible shape, invariably contains different areas, the area increasing the nearer the boundary approaches to a circle. This the Practical Mechanic may readily prove, by lengthening with his finger a circular string: it will by-and-by leave an almost imperceptible area, bearing the smallest possible proportion to its once circular arrangement.

An acquaintance with this fact, which farmers and others conversant in shaping inclosures would do well to remember, would probably have shown the fallacy of the Practical Mechanic's idea.

AN EXPERIMENTER.

LITHOGRAPHIC PAPER.

London, April 30, 18[illegible].

GENTLEMEN;—In reply to a letter in your last Number, complaining of the manufacture of lithographic paper, permit me, for the honour of our *paper mechanics*, to inform your correspondent, that so far from being inferior to our continental neighbours in this manufacture, a very superior lithographic paper is now made in England, as is attested by several of our most eminent lithographers, and your correspondent may easily learn where it may be procured, by application at your Publishers, with whom I have left the maker's address.

Your obedient servant,
PHILO-LITHOGRAPHICUS.

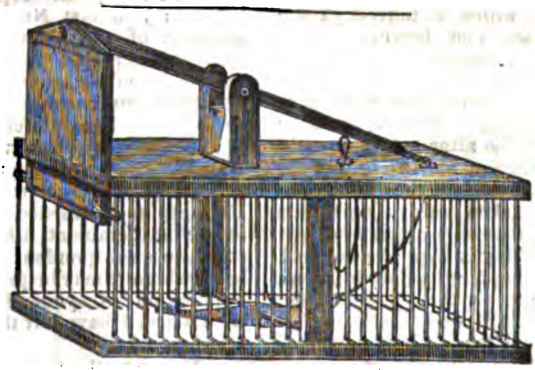
SIMPLE MODE OF RAISING LARGE BLOCKS OF STONE.

GENTLEMEN;—On the borders of England and Scotland a very simple method has for some years been used for removing from the fields the blocks of whin-stone (basalt) which in some parts of that district are very numerous; and as I think it might be advantageously employed in many cases, instead of the more complicated machinery, I have taken the liberty of sending you a short account of it for insertion in your valuable Magazine, should you deem it worthy of a place there.

A perfectly circular and perpendicular hole must be made in the stone, of about half or three-quarters of an inch in diameter, and about three inches in depth; into this must be driven with a hammer a cylindrical iron bolt, of about the same length, and in diameter only *so much* smaller, that it will not need much force to drive it to the requisite depth (about $2\frac{1}{2}$ inches). In the upper part of this bolt or plug is a hole or ring, for the purpose of receiving the tackle by which the stone is to be raised. In the instances where I saw it used, the means employed were a common triangle and roller with levers; and by it I witnessed a stone of three or four tons weight raised, from which the ground (in which it was nearly buried) had not been removed, so that the resistance was much greater than its weight. In another case, the tackle, for want of sufficient strength, gave way, but the bolt remained firm. After raising the stone, the bolt may be removed by a few slight blows on the side with a hammer. I may remark, that it can only be applied to hard and tough stones, such as granite, whin, compact lime, but not to Bath stone, free stone, &c. Can any of your readers account for the curious circumstances of the perfectly cylindrical bolt remaining so firmly fixed?

Your most obedient,

NORTHUMBRIENSIS.



IMPROVED RAT-TRAP.

The rat-trap exhibited in the above drawing, must be allowed to be a considerable improvement on the common rat-trap. I have known instances where the rat will go in the traps to the bait, and come out again without being caught; but this cannot be the case here; for when the rat puts his paws on the bridge (before he gets to the bait), the door falls down, and secures him.

C. BELLAMY.

INQUIRY AFTER A REMARKABLE PIECE OF MECHANISM.

GENTLEMEN;—I inclose a bill of a piece of machinery which I saw at Mr. Burt's, Exeter, some time since (but from which bill little can be learnt). If any of your readers can give *a more particular description* of it, and the little that is known of the inventor, I make no doubt it will gratify many of them, and perhaps be the means of enrolling the name of Lovelace in the list of those who have done honour to their country by their mechanical genius.

I am, Gentlemen, yours, &c.

W. W.

Admirable Production of Native Genius, &c. invented by a native of Exeter, of the name of Lovelace, upwards of one hundred years since, containing the following movements:—

A TIME-PIECE, striking the Hours, Quarters, &c.

A PERPETUAL ALMANACK, which has an exclusive Movement for the *Leap Year*, requiring to be regulated once only in 100 years, the principal wheel in which revolves but once in four years.

On a plate, in the centre of the face, is seen the SUN in his course through the heavens, as he appears to us. The circle which he makes is beautifully described in the changes of the seasons, by the horizon receding or advancing as the days lengthen or shorten.

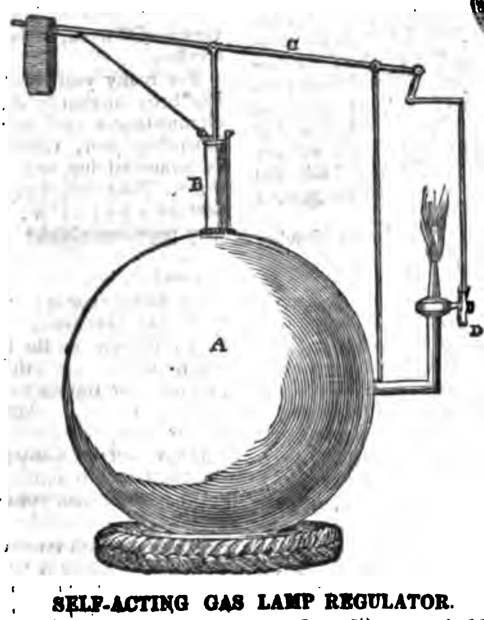
Under the above is seen the MOON, showing her Age and Wane, as she appears to us in her different stages.

AN ORGAN, playing a variety of pieces, that produce a most delightful harmony, the figures of which are brilliant beyond any thing of modern composition.

A BELFRY, in which are Six Figures ringing the Changes on Six Bells.

A variety of other figures are shown, in motion, playing Instruments, beating Time, &c.

The whole is contained in one splendid PILE of CABINET WORK, ten feet high, five feet wide, and weighs upwards of half a ton; the sculpture, paintings, and embellishments of which, though executed more than 100 years since are not surpassed for workmanship or beauty in the present day, and strike the beholder with admiration; but, at the same time, with regret, that an individual, whose powerfel intellect and refined mind could execute so extraordinary a machine, *should have died in a workhouse*.]



SELF-ACTING GAS LAMP REGULATOR.

Kidderminster.

GENTLEMEN;—In one of your Magazines I find mention of a Portable Gas Lamp, which was used at the Mechanics' Institution. I presume it is nothing more then gas condensed into a suitable vessel; and as it is troublesome to regulate the stream, I trust an invention for a self-acting regulator will be acceptable. You will receive herewith a drawing of one, which is so simple, that little or no explanation is required. The expense of the regulator will be very trifling.

I am, Gentlemen,
Your constant reader,
J. Reywor.

Description of the Engraving.

A, the reservoir of condensed gas; B, a small cylinder, with a solid piston and rod connected to a lever C, which has a moveable weight, and that lever is connected to the cock D, which will open in proportion as the piston falls, which will be the case as the pressure decreases. If it is necessary to lessen the weight as the pressure of the gas diminishes, it may be done by communicating the weight to the piston with a string, wire, &c.

Improvement of the Condition of the Working Classes.

King's Head, Poultry, April 13, 1824.

Gentlemen;—Having the satisfaction of knowing that the views entertained by this Society* on the subject of relieving the wants of our distressed countryman, the British peasant, by means of *land*, are approved by Dr. Birkbeck, and not doubting that your sentiments on the subject will be in unison with his, I take the liberty to address you on the present occasion.

This little Association having been occupied for several years upon the consideration of means to raise the peasantry from their abased dependence upon poor-rates, to occupy their real standing in our community, the communications with which they have been favoured by a considerable number of characters of weight and influence, and practical persons, as surveyors, parochial officers, and large landed proprietors, have tended to show that labourers occupying small portions of land are generally industrious, and of moral habits, and independent of poor-rates; that their children have healthful, and congenial employment; and that when such practice prevails, a harmony generally exists between the employers and employed, and mutual interest is consulted. Whatever notice you may be pleased to give this subject, will be considered an obligation by the Association, for whom

I have the honour to be,
Gentlemen,
Your obedient servant,
B. Willis.

* For Bettering the Condition of the Poor.

We cannot too strongly recommend the objects of this laudable Institution to general support; nor, perhaps, better promote them at present than by inserting the following letter with which we have been favoured from a respectable magistrate in the country, which furnishes a very striking practical illustration of the benefits of the system promoted by the Association.

To the Editors of the Mechanic's Magazine

Woodfield, near Newport, Monmouthshire, May 1, 1824.

Gentlemen;—If the following account of a local experiment be considered worthy of insertion in your very useful work, it is much at your service.

For many years past my attention has been anxiously directed to the circumstances and situation of the labouring poor, whether in manufacturing, mining, or agricultural concerns. The result of my observations, both as a man and a magistrate, in a very populous district, has long since convinced me that the industrious classes in this country are not fairly dealt with, being generally (in addition to the operation of a burthensome, though mostly indirect taxation), either from thoughtlessness, prejudice, or rapacity on the part of those who ought to have been their friends and protectors, depressed and impoverished to a degree rendering their situation all but hopeless. And yet the efforts made to avoid the humiliation of parochial relief, substantiated by the fact verified in the returns to the House of Commons, that not less than 900,000 individuals of these classes had for that laudable purpose entered into Friendly and Provident Associations, combined with abundance of other, though less striking facts of a similar nature, afforded me sufficient proof that the reduction of two millions of our population to a state of pauperism and dependance was imputable, in the case of a very great proportion of that number, rather to misfortune than crime.

Amongst other attempts to ameliorate the condition of the labouring poor within the sphere of my personal influence and means, consequent on this conviction, I have encouraged labourers, consisting chiefly of persons working in or connected with the collieries of this neighbourhood, to build themselves dwelling-houses on land offered them for that purpose at low ground-rents on lives, or 99 years lease, with stone, tile, and timber for the roofs, from adjacent parts of the same estate. The result has been the conversion of a tract of woodland into a picturesque, populous, and thriving village, inhabited chiefly by the families of colliers, shopkeepers, and mechanics. Each cottage has its appropriate and ample sized garden, many of which already do no discredit to the industry of their owners. In the village is a public-house, now enlarging for the comfortable accommodation of strangers and travellers; a weekly market has been established in a small but convenient market-house, built for the purpose; and a large room erected for the joint and congenial uses of a school, and chapel will shortly be opened for religious worship and instruction, on the comprehensive and scriptural basis of the Bible Society. Already results, both interesting and gratifying, are conspicuous, and the prospects of farther progressive improvement abundantly encouraging. Any industrious person (a collier for instance) by his own personal exertions, particularly in the summer-time, out of working hours, and by borrowing the money necessary in addition thereto, may acquire a good and substantial stone-built house, affording accommodation for himself and a middle-sized family, and a garden of one-eighth part of an acre, besides having a room to spare for two lodgers, whose weekly pay will amply discharge the interest of the money borrowed, as well as all other outgoings in respect of the property thus acquired, even if the whole money necessary for the building have been borrowed; so that the owner may not only live in the house, and have the produce of his garden rent-free, but be enabled to lay aside money yearly towards the extinction of the debt incurred. This is the case of a man destitute of *pecuniary* means: those persons who have already a part, or the whole of the sum required (not exceeding 25*l.*), of course do still better; but there is no industrious man of good character who may not be accommodated with the money on security of the premises; and where, as in this part of the country, houses of the description alluded to will rent for 5*l.* or 6*l.* a-year, I know of no benefit club a man can enter into so certainly advantageous to himself and his family; though I am of opinion a saving or deposit bank, or benefit club, might be appended to the scheme with additional advantage. It will, indeed, ere long, be tried, as will also the establishment of a village library, of which the Mechanic's Magazine will not fail to form a part; and the establishment of a Mechanic's Institution, I hope, will be a result. With my warmest wishes for the increasing success of both,

I am, Gentlemen,

Your obedient servant,

John H. Moggridge.

MEASURING OF ROUND TIMBER.

Tring, Herts.

Gentlemen;—In Number 39, page 56, your correspondent Measurage having geometrically explained the cause of difference between customary measure and the true contents, I now present your readers with some expeditious methods of measuring round timber, making an allowance for the thickness of bark, as the case may require.

Let a person provide himself with a tape marked with inches for girthing of trees, when he will find the following rules accurate and expeditious:—

Rule 1.—No allowance to be made for bark.

Multiply the length in feet by the square of the whole girth in inches, and divide by 2304; the result gives cubic feet, customary measure.

Rule 2.—To allow $\frac{1}{8}$th for bark; as for elm timber.

Multiply the length in feet by the square of the whole girth in inches, and divide by 3009 = cubic feet, customary measure.

Rule 3.—To allow $\frac{1}{10}$th for bark.

Multiply the length in feet by the square of the whole girth in inches, and divide by 2845 = cubic feet, customary measure.

Rule 4.—To allow $\frac{1}{12}$th for bark, as for beech.

Multiply the length in feet by the square of the whole girth in inches, and divide by 2742 = cubic feet, customary measure.

Note.—A tree measures the most possible when the girth at the smallest end is $\frac{1}{3}$rd of the largest end.

But as these rules are more elegantly expressed by algebraic terms, allow me to add the above rules with others for finding the true content.

Let L denote the length of tree in feet and decimals, and G the whole girth taken in inches; then

Rule 1.—No allowance for bark.

$$\frac{LG^2}{2304} = \text{cubic feet, customary, and } \frac{LG^2}{1807} = \text{cubic feet, true content.}$$

Rule 2.—To allow $\frac{1}{8}$th for bark.

$$\frac{LG^2}{3009} = \text{cubic feet, customary, and } \frac{LG^2}{2360} = \text{cubic feet, true content.}$$

Rule 3.—To allow $\frac{1}{10}$th for bark.

$$\frac{LG^2}{2845} = \text{cubic feet, customary, and } \frac{LG^2}{2231} = \text{cubic feet, true content.}$$

Rule 4.—To allow $\frac{1}{12}$th for bark.

$$\frac{LG^2}{2742} = \text{cubic feet, customary, and } \frac{LG^2}{2150} = \text{cubic feet, true content.}$$

EXAMPLE by *Rule* 1.—No allowance for bark.

A tree 40 feet long, and 60 inches whole girth or circumference.

$$\frac{40 \times 60^2}{2304} = 62\tfrac{1}{2} \text{ cubic ft. customary, and } \frac{40 \times 60^2}{1807} = 79\tfrac{2}{3} \text{ cubic ft. true content.}$$

Ex. by *Rule* 2.—A tree 50 feet long, and 49 inches circumference.

$$\frac{50 \times 49^2}{3009} = 40 \text{ cubic ft. customary, and } \frac{50 \times 49^2}{2360} = 50\tfrac{7}{8} \text{ cubic ft. true content.}$$

Note.—The divisors in the above Rules are given to the nearest whole number, being sufficiently correct for practical purposes.

For engineers, carpenters, and mechanics in general, who use a sliding rule whose D or girth-line begins with unity, the following formulæ will be useful. Let A B C D represent the lines on the rule.

A	2304 divisor, no allowance for bark.
B	Length of tree in feet.
C	Solidity or cubic feet, customary measure.
D	Whole girth in inches.

If a common carpenter's rule, take the square root of the above given numbers, and use the lines C and D.

Thus, C	Length in feet.	cubic feet answ. customary measure.
D	48, no allowance for bark.	whole girth in inches

The proportion of customary measure to cylindrical is as 11 to 14.

Yours, WM. ANDREWS.

THE CUBE ROOT.

The inquiry of our correspondent (J. T.) respecting an abridged method of finding the third root of numbers, has produced a great many letters, communicating plans of various degrees of merit. Finding it impossible to publish them all, we offer two to our readers, and our approbation of all who have attempted the subject. In our opinion, no abbreviation could compensate for the simplicity of the common rule, and the care with which it can be investigated, either arithmetically, algebraically, or geometrically. The form in which any one instance of extracting the Cube Root presents itself, is this:—To divide a given number in such a manner as that the quotient shall be the square root of the divisor; and if this quotient is to be found at once and as one number, the data are, upon the common principles of arithmetic, inadequate; and there is no mode of solution but by trial and error. If the given number be not greater than the cube of 9, and its root, of course, not greater than 9, this is the surest method; but when it exceeds this, the best way is to consider the root as made up of two parts, and then, from an examination of the cube of the sum of two numbers, we deduce the rule. Thus, let 24 be the sum of the two numbers 20 and 4: squaring this, we obtain,

Multiply 20 and 4
by 20 and 4.

20×20 and 20×4, product by 20;
20×4 and 4×4, product by 4.

Hence the square is 20×20 and $2\times20\times4$ and 4×4;
Multiply by...... 20 and 4

$20\times20\times20$ and $2\times20\times20\times4$ and $20\times4\times4$ by 20;
$20\times20\times4$ and $2\times20\times4\times4$ and $4\times4\times4$ by 4.

Hence the cube is $20\times20\times20$ and $3\times20\times20\times4$ and $3\times20\times4\times4$ and $4\times4\times4$.

By inspecting these four quantities, which compose the cube of 24, taken in turns of its parts, 20 and 4, we find that they are—

1st. $20\times20\times20$, which is the *cube of the tens;*
2nd. $3\times20\times20\times4$, which is *three times the square of the tens multiplied by the units;*
3rd. $3\times20\times4\times4$, which is *three times the tens multiplied by the square of the units;*
4th. $4\times4\times4$, which is the cube of the units.

There are three 0's annexed to the cube of the tens; therefore, three figures in the right of the given number must be left for the units. There are two 0's on the right of the second line, one on the right of the third, and none in that of the fourth. Performing the multiplication, the four lines would stand thus:—

1st.	Cube of tens (2)	=	8000
2nd.	3 times square to tens (2) multiplied by units (4)............	=	4800
3rd.	3 times tens, by square units .. .	=	960
4th.	Cube units	=	64
			13824 Total cube;

in which it will be observed that the cube of the tens is actually contained in the first and second figures (13). Well, suppose that cube were taken away, and the other quantities divided by the units, the sum of the results would give a divisor which, upon dividing, would give the units for quotient. Those three parts of the divisor would be,

1st. 3 times the square of the tens, or the tens figure squared, and multiplied by 300.

2nd. 3 times the product of the units and tens, or the product of the figures multiplied by 30.

3rd. The square of the units.

This is the common rule; and as it is evident that all the figures of a number to the left-hand of any one figure, are tens in respect of that figure as units, it may be extended to any number of figures whatever.

The *algebraical* investigation is more elegant in form, but exactly the same in principle. Let $a+b$ be any number, of which b denotes the last figure, and a all the figures but the last: according to the former multiplication, the cube of $a+b$ will be

$$a^3+3a^2b+3ab^2+b^3.$$

Subdividing the first term (a^3), and dividing the other terms by b, the whole divisor is

$$3a^2+3ab+b^2;$$

in which, it will be observed, that two 00's must be added to the square of the *figures* denoted by $3a$, and one 0 to those denoted by $3ab$; also, that every time a value of b is found, it makes an additional figure to a.

In a future Number we shall give the geometrical analysis, which has been offered by a correspondent, though not in so brief and clear a manner as is desirable. The following are the two communications which we have selected as, in our judgment, throwing most light on the subject.

GENTLEMEN;—Several methods have lately been offered by different mathematicians to extract the cube root of any given number, the most valuable of which are the three following, namely, that given by Mr. Horner in the "Philosophical Transactions for 1819;" that proposed by Mr. Nicholson in his "Analytical Essays, 1820;" and that given by Mr. Young in his "Elementary Treatise on Algebra," lately published. The last mentioned is, in my opinion, decidedly the best, and is certainly the shortest that has ever been proposed. As this method is at present but little known, I cannot better meet the wishes of J. T. than by transcribing it at length, referring, however, to the work itself for an investigation of the principles on which it is founded.

New method to extract the cube-root of any given number.

Divide the given number into periods of three figures each, as in the common method, and find the nearest cube to the first period, and put the root in the quotient; then thrice the square of this root will be the trial divisor for finding the next figure.

Draw a line a little below the trial divisor, multiply the new figure with thrice the preceding prefixed, by the new figure, and place the first two figures of the product *below* this line, and to the right of the trial divisor, and the others *above* the line; add them to the trial divisor, and the sum will be the true divisor.

Under this divisor write the square of the last root figure, which add to the two sums above, repeating the two first figures of the divisor twice, and the result is the next trial divisor; the true divisor is found as before, &c.

Note.—After the first or second decimal in the root is found, the square of the root figure used in forming the trial divisor may be omitted, as also these two figures that would fall below the line in forming the true divisor, as the value of these figures will be too small for their omission to affect the truth of the result. But if the number of decimals in the root is required to be very great, these omissions must not be made till after the third or fourth decimal in the root is found

Example I.—Extract the cube root of 12326391

	12	12326391 (231 = root.
	1	8
63..	———	—
	1389	4326
	9	4167
	———	———
	1587	159391
	6	159391
691..	———	———
	159391	
	———	

Ex. II.—Extract the cube root of 3 to three places of decimals.

```
               3          3 (1·442 = root.
               1          1
         3·4.. ────       ────
              4·36        2
               ·16        1·744
              ────        ────
              5·88        ·256
                17        ·242
         4·2.. ────       ────
              6·06         14
              ────         12
              6·2         ────
                1           2
              ════        ════
```

The above method is deduced by the author from a new process for extracting the roots of cubic equations, which is very simple and ingenious, and which must be referred to by those who would understand clearly the principles of the above operations. Indeed, your mathematical readers will find several novelties in Mr. Young's Algebra not to be met with in any other publication.

Yours respectfully,
R. Stoen.

March 18, 1824.

Gentlemen;—As it appears that the request of your correspondent J. T. concerning the cube root is one of *common* arithmetic, and meant to be independent of logarithms, I have carefully considered the subject, and have deduced a rule for the purpose, which will, I think, in a great measure, if not altogether, satisfy your correspondent.

The process may appear at first sight rather complex; but it will be found easy to remember, and an example will show its simplicity. The operations are extremely simple, and wholly free from those subordinate extraneous operations in squaring and multiplying together high numbers which render the common rule so laborious, and may be worked with the greatest facility by any person who will make himself acquainted with the nature of them.

Rules. — Point every third figure, find the greatest cube in the left-hand period, subtract it from that period, and bring down the next period to the remainder; this is the resolvend.

Triple the root, and place the product some way to the left hand of the resolvend; multiply this product by the root, and calling the resulting product A, place it between the former product and the resolvend. Find how many times A is contained in the resolvend (omitting the two figures on the right); annex the quotient to the root, and also to the product which stands to the left of A; multiply this result by the quotient, and place it under A, moving it two figures to the right; add these two lines together, and the sum multiplied by the quotient will give the subtrahend. Subtract it from the resolvend, bring down the next period, and proceed as before, the quotient now becoming the last figure of the root.

It is particularly to be observed, that the finding the successive products (A) would become very laborious; but from the peculiar manner in which I have disposed the numbers, they will be obtained immediately by addition: thus, to find any product (A), add together the two lines which stand under the preceding product (A), adding at the same time the square of the last figure of the root, which will be an easy operation, since it cannot exceed 81.

Example I.—To extract the cube root of 395446904 (734 *Answer*.

```
                        343
                        ───
  213....147   )       52446
         639   )       46017
       ─────   )       ─────
       15339   )
 2194...15987  )     6429904
         8776  )
     ───────   )     6429904
     1607476   )     ═══════
     ═══════
```

Here 7 is the first figure in the root, and 52446 the first resolvend; also triple of 7 = 21, and 21 × 7 gives 147 = (A), which is contained in 524, three times which quotient 3, annexed to 21, gives 213; this, multiplied by the quotient 3, gives 639, which is placed under 147. The sum is 15339, and this, multiplied by the quotient 3, gives 46017 for the subtrahend. Again,

Triple of 73 = 219, also 639 + 15339 + square of 3, make up* 15987, which is (A), and quotient of this in 6429 is 4, which, annexed to 219, gives 2194; this multiplied by 4, gives 8776, which, added to 1598700 gives 1607476, and lastly, multiplying this by the quotient 4, we obtain the subtrahend.

* This quantity 15987 might be attained by taking the product of 73 × 219, but the above is much the readier way.

Ex. II.—To extract the cube root of 2888880.

```
                             2888880 ( 142·421 + Answer.
                             1
                             ----
         34....3   )         1888
             136   )
             ---   )         1744
             436   )         ----
      422....588   )          144880
             844   )
           -----   )          119288
           59644   )          ------
    4264....60492  )           25592000
           17056   )
         -------   )           24265024
         6066256   )           --------
  42722....6083328 )            1326976000
            85444  )
       ----------  )            1216836488
        608418244  )            ----------
427261....608503692 )            110139512000
           *427261  )
      -----------   )            60850796461
      60850796461   )            -----------
                                 49288715539
```

We may observe that the successive triples down the left hand may be very conveniently found by adding to the preceding number twice its last figure, instead of continually multiplying the root by 3.

I have endeavoured to assimilate this rule as far as I could to that for the extraction of the square root, and as a proof of the merit of it, we need only *attempt* to work out this root to six places by the common rule, whereas, by this method, we might, with very little difficulty, have continued it further, the *highest multiplication* being by multipliers under 10.

This example (which is, I suppose incorrectly, printed 288888 in last week's Number), confirms Mr. Bevan's opinion, and shows that for all practical purposes we shall never be in want of a method, as long as we are possessed of logarithms.

I need only add, that I am sorry to take up so much of your valuable paper, but must plead as an excuse the nature of the subject.

I am, Gentlemen, &c.

MUTIUS.

NEW PATENTS.

To Rupert Kirk, of Osborne-place, Whitechapel, dyer; for a new method of preparing or manufacturing a certain vegetable substance, growing in parts abroad beyond the seas, and imported to and used in these kingdoms, as a dye, or red-colouring matter, for the use of dyers, called Safflower *(Carthamus)*; so as more effectually to preserve its colouring principle from decay or deterioration in its passage, from the places of its growth, to England and other parts of Europe.—Dated March 20, 1824—two months.

To Henry Berry, of Abchurch-lane, London, merchant; for certain improvements on a machine or apparatus for more readily producing light.—Dated March 20, 1824—six months.

To Jean Jacques Stainmare, of Belmont-distillery, Wandsworth-road, Vauxhall, distiller; who, in consequence of communications made to him by certain foreigners residing abroad, and discoveries by himself, is in possession of an invention of improvements in the process of and apparatus for distilling.—Dated March 20, 1824—six months.

Answers to a long list of correspondents in our next.

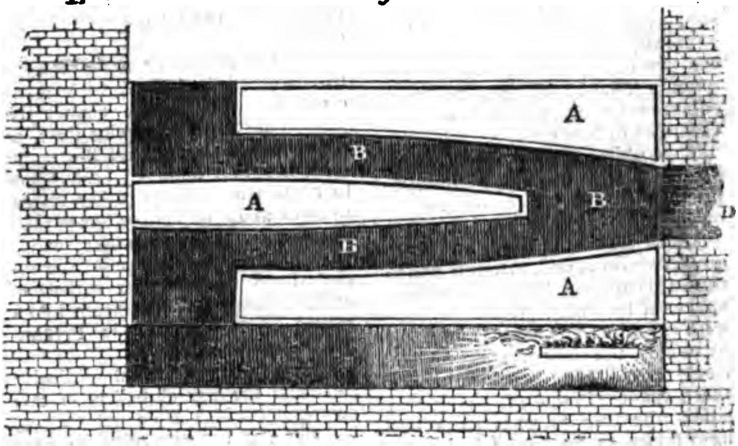
T. C. Hansard, Pater-noster-row Press.

Mechanic's Magazine,
Museum, Register, Journal, & Gazette.

He alone appears to me to live, and to enjoy life, who seeks after reputation by some famous action or *some useful art*.—*Sallust*.

No. 39.] SATURDAY, MAY 22, 1824. [Price 3*d*.

Fig. 2



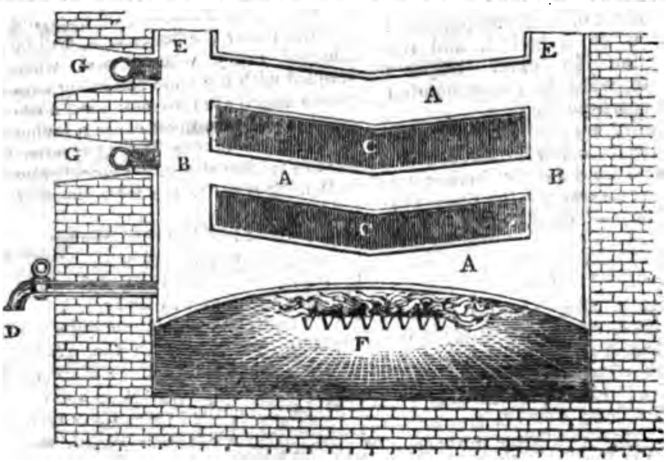


Fig. 1.

IMPROVEMENTS ON PICKERING'S STEAM-BOILER.

March 19, 1824.

GENTLEMEN;—Your 29th Number contains a plan for a Steam-engine Boiler, which appears liable to one most important objection. The steam cannot have sufficient room to escape, in consequence of the circuitous rout it must take before reaching the steam-pipe. The greater part being generated immediately over the fire, the water in the upper part would consequently be carried into the steam-pipe; in short, the vessel would be perpetually boiling over, which, it is almost unnecessary to say, proceeds from steam being generated so rapidly as to carry the water before it, which frequently enough takes place in a common boiler, with all the advantages of free escape.

This objection I conceive may be obviated, and all the advantages procured by a boiler constructed on the following plan:—

Let the boiler consist of an oblong quadrilateral vessel, through which the flue is to pass. The intermediate spaces of the boiler to communicate with the sides (as at A B, fig. 1), by which the steam may escape freely from each compartment; these spaces to open from side to side; the flue to pass from behind forwards, &c. (as at B, fig. 2).

The weight of each compartment may be 6 or 8 inches, and the construction in other respects similar to what is recommended by your correspondent.

A similar method may also be adopted in inclosing the three sides, which will be done by having an upright reservoir at the back (as at E, fig. 2).—Yours, &c.

J. R.

Description of the Drawing.

Fig. 1, a front section of the boiler; A A A, compartments of the boiler; B B, upright portion of do., with which the former communicates; C C the flue; E E, steam-pipes; F, fire; G G, screw plug-holes for cleansing the compartments; D, stop-cock.

Fig. 2, a *side section* of the boiler; A A A, compartments of the boiler; B B B, flue; D, an opening in front to clean the flue; E, reservoir of water at the back (if considered necessary).

STEAM BOILERS.

In Mr. Pickering's proposed Steam-Boiler, of which a description is given in your 29th Number, I cannot see how high the water is to stand so as to leave a certain space for the steam to rise, as the water forced into the bottom compartment must fill that as well as the two upper parts, until it rises to the level of the float attached to *b*.

Would not three or more separate and detached flat boilers, without the connecting side-curves, answer the purpose better, if fixed with flues, or rather with a single broad flue under each, one over another; each boiler to contain a distinct floating gauge, so as to allow of half or less of their depth to be filled with water, and a connecting pipe of adequate dimensions fixed to the upper surface of each, to carry off the steam into a reservoir, as is done in Perkins' Steam-Engine?

Unless some practical difficulty occurs in the use of boilers of this description which I do not foresee, I doubt not but the principle proposed by Mr. Pickering of applying the fire under the boiler *only*, will be adopted every where; and when coupled with the wide-spreading fire-places which are now obtaining a decided preference, must cause a saving of one-third of the fuel at present used in raising steam. Theoretically it is most correct, the art of heating fluids by the combustion of fuel being neither more nor less than projecting atmospheric air, mixed with caloric, upon the surface of the metal which contains the liquid to be heated, imparted to which, the caloric quits the metal to combine with the water, the particles rising to the surface as fast as heated; if the heat is applied to the sides of the vessel, more than two-thirds of the ignited fuel so used must be wasted.

It has often occurred to me that a series of experiments should be made by consumers of fuel, with metal surfaces of various areas. This might be done by fixing and adjusting small boilers at different distances over an Argand lamp; and by noting the quantity of water boiled oil in a given period, with the weight of oil consumed, the best *form* of boiler would be found. The effect of hydrostatic pressure on the boiling of water, and raising it into steam, would also be shown; that is, how much more steam it would be possible to generate with a broad flat-bottomed boiler, covered with a few inches of water, than with a deep upright one, containing a weight of water of considerable pressure; and by forming small flues under flat, experimental boilers, placed one above another, the lamp under the lowest, it might be seen how far the heat of the fuel could be carried upwards before it becomes so exhausted as to be of little or no use in *boiling*. This is surely deserving of inquiry; for I have little doubt that much of the heat given out by coals burnt in the fire-places of steam-boilers of the very best construction is dissipated and lost by flowing up the chimney, and particularly so when quick and strong steam is wanted.

I have long entertained the notion which Mr. Pickering throws out, that it is to the best mode of applying heat for generating steam we must look for the future improvement of the steam-engine. And when it is considered how small a fire will heat a large surface of iron or copper to redness many degrees hotter than boiling water, it becomes matter of great interest to apply this power of ignited fuel to metallic surfaces in such a way as to lose *no* portion of the heat which is given out.

T. C. H.

CAPTAIN MANBY.

[We readily give insertion to the following letter, since it regards a vindication of character. It will be perceived, however, that it by no means negatives the matter of fact of which we complained, namely, that Lieutenant Bell, who was by many years the first inventor of what has got the name of Captain Manby's Invention, was passed unnoticed and unrewarded by the nation, while one who did no more than carry his long-neglected suggestions into effect, reaped both all the honour and all the reward. It is quite possible that Captain M. may have known nothing of Lieutenant Bell's prior invention; nor is our fault so much with him as with Parliament, who, apprised of Lieut. Bell's claims, omitted nevertheless to do him the justice he deserved. It must be confessed, however, that our correspondent does not add to the probabilities in Captain M.'s favour, when he tells us farther, that Captain M. was actually a member of the Society to which Lieutenant Bell communicated his invention, and must of course have been in possession of its Transactions.—ED.]

Mundesley, May 13, 1824.

GENTLEMEN;—I have just read in your Magazine for March 30th, a very severe, and, in my opinion, unfounded attack on the character of Captain Manby. You boldly assert that the mortar invention is of thirty years standing; that Lieutenant Bell of the Royal Invalid Artillery was the inventor, and that Captain Manby had received from Parliament large rewards for this invention, while Lieutenant Bell's family had, in fact, received nothing. Now, Sir, as I am acquainted with Captain Manby's honourable character, and as that gentleman may not probably see your publication, I take upon myself to explain away the erroneous information you have promulgated. It is not impossible that two persons might have invented the same thing at the same time; and if Captain Manby was not acquainted with Lieutenant Bell's invention, the plan he recommended and brought into use was still his invention. I know that it has been objected to Captain Manby's being the inventor; that, being a member of the Society of Arts, he must have read the accounts published by Lieutenant Bell, and have seen the models in their repository of Lieutenant Bell's mortar, shell, &c. Now, Sir, this is very improbable, as Captain Manby could not have inspected this apparatus without being seen by some one, and the notoriety of the reward given to the Captain would have induced some honest man to bring such a gross fraud to light. And as a further proof that Captain

Manby did not steal the invention from Lieutenant Bell, and that he had not read the article in the Society's Transactions, it is allowed by all competent judges, that Lieutenant Bell's mortar and shell are far superior and more certain of effecting the intended purpose than those used by Captain Manby.

I believe I may, without fear of contradiction, state, that Capt. Manby received the first intimation of the plan from a very praiseworthy gentleman, Captain Wheatley, of Mundesley, whose exertions in saving the lives of shipwrecked persons, have been repeatedly and publicly noticed, and for which he has received the most distinguished and marked thanks of his friends in this neighbourhood. A gentleman, I think a clergyman of the North of England, having been told of Mr. Wheatley's exertions in the cause of humanity, informed him of some experiments he, the clergyman, had been making with a common musket, with which he succeeded in throwing a small ball over a house, and that he wished Captain Wheatley to try the experiment on a larger scale. Captain Wheatley modestly acknowledged his ignorance of gunnery, but said he would mention the matter to Captain Manby, a friend of his, who was a very ingenious man, and who had invented a life-boat, which was kept buoyant with bladders, and in which invention he had completely succeeded. The result was, that the subject was mentioned to the Captain, and he brought the project to bear, and for which, as you say, he has been liberally rewarded.

I am, Gentlemen,

Your obedient humble servant,

W. B.

CAUSES OF THE PERPETUAL MOTION—DELUSION.

Portsmouth, March, 1824.

GENTLEMEN;—Having on two former occasions alluded, at some length, to the reasons which have prevented the discovery of perpetual motion, I will now say a few words on the reasons why so many have been misled. The cause of this too frequent error I take to be as follows:—When a person fancies he has succeeded in hitting upon some particular method, which will enable him to construct a machine, that will move for ever, *instead of reducing his proposed plan to its simple principle of action, and divesting it of all wheels, screws, springs,* &c., he commences his labour, and so bewilders himself with a complication of forms, that at last he loses sight of the principle on which the machine is intended to act. This method is likely to deceive all, but certain to betray into an error those who are unacquainted with the elementary principles of the science of mechanics; *and all who look after such a motion, are to be included in this class.* If a machine supposed to be capable of moving for ever, were submitted to me for an opinion as to its capability, my first object would be to strip it of all those complications which it may perhaps have been the inventor's chief study to introduce, after which, I should be the better enabled to examine its construction, with a view to ascertain *the principle on which it acted; and however numerous the wheels, or complicated the machinery, its principle of action might be readily discovered.* Suppose, for instance, a weight, attached to one end of a cord, be made, by its descent, to give motion to a wheel; when the weight reaches the ground, it can no longer descend, so that the motion would cease; but at this critical moment, it is intended that a strong spring should be made to act on the axle of a rolling cylinder above, and by turning it round, wind up the weight again. Now, without giving myself any trouble to inquire whether the weight be heavy enough, or the spring strong enough for this purpose, I should immediately perceive that the machine acted on the principle of the lever; for the rope to which the weight or acting power is attached, is passed round the extremities of the radii of the cylinder, and these radii are so many levers of the first kind, the ends nearest to the circumference being the parts where the power and resistance is alternately applied, and the centre of the axle forming the fulcrum. The weight, therefore, acts in exactly the same manner as if a number of men were to place their hands on a series of levers, resting on a common fulcrum, and acting on a common resistance. When the weight has arrived at the earth, it is supposed that the spring will begin its work, and by acting on the cylinder, will wind it up again. Now, the spring is a lever of the third kind, the weight of the machinery being the resistance, the fixed end of the spring the fulcrum, and the elastic force of the spring the acting power which is situated between the fulcrum and the resistance. The machine, therefore, being nothing more than a complication of levers, acting on each other, I have only to ascertain whether a lever will enable me to produce an effect, greater than the power made use of, and in all my experiments I shall find, that if I gain power (commonly so called) I must lose time, and if I gain time I must lose power. If, therefore, a weight of one pound be applied to the end of a lever 12 inches long (*which will be the case when a rope acts on the circumference of a cylinder, 2 feet in diameter*) the effective force of the resistance will be to this power of 12 pounds, as the distance between the fulcrum and the resistance is to the distance between the fulcrum and the power; and if the distance between the fulcrum and resistance be only 1 inch, then the power of 1 pound at 12 inches from the fulcrum, will *be 12 times as effective* as the resistance of 1 pound, at 1 inch from the fulcrum, *but the operation must be repeated 12 times before the resisting part of the machine will travel through a distance equal to what the acting power travels every time.* Weights, therefore, placed in various situations, on levers, act on the same principles, which in my letter (page 422, Vol. I) of your Magazine, I have applied to wheels, and by a reference to the observations therein contained, it will be seen that no lever (or wheel) can have the property of generating power, and we may thence safely conclude, that no machine, depending on the principles of the lever, can possess this property. If means similar to these were resorted to, we should not hear of so many attempts to produce perpetual motion; for since there are only 6 mechanical powers, *and these may even be reduced to 2, the lever and inclined plane*, so every complication of wheels, planes, pulleys, wedges, springs, &c. &c. are modifications of one or the other of these two; and *however much the shape or construction of them may be disguised, we shall find that the action of every machine, without a single exception, may be referred to the principles of the lever or inclined plane.*

It is only by a nice and scrupulous examination of these simple laws, on which every science is founded, that we can ever expect to render their application important and useful; for since the most energetic machines are all formed from various combinations of the most simple materials, made effective by a peculiar application, and judicious arrangement, so, by a careful examination of the nature and properties of these simple materials, can we alone be made acquainted with the powers of such machines as depend on them; and whether we take a survey of the inventions of Brunel or Watts, in the stupendous application of the power of steam to steam-engines, or view the enormous masses of stone which are sent from their beds of solid rock by so diminutive an instrument as a wedge, or whether we look at the more humble machinery of the turning-lathe, or the still more humble attempts of those who look to the discovery of *perpetual motion*, we shall find that these several machines are all made of the same materials, are all reducible to the same principles, and are all dependant on those two simple mechanical powers, the lever and the inclined plane; *and if these be not sufficient for our purpose, no machine can ever be constructed that will be more effective.*

I will take the liberty, in a future Number, of considering the subject in *one more point of view*, which I believe will be sufficient for my purpose; and, indeed, had it not been that I find some of your correspondents *determined to think their object attainable*, notwithstanding the universal failure of all who have been in pursuit of it, I should not have troubled you by being so tedious; but, as those to whom I am directly addressing myself cannot be acquainted with the elementary principles of mechanics (or they would never think of perpetual motion), I have felt it necessary to consider the subject more minutely, with a view to convince them of their error.

I am, Gentlemen, yours &c.
HENRY DEACON.

MENDHAM'S IMPROVED METRONOME.

Percy-street, May 14, 1824.

GENTLEMEN;—In your Magazine of the 8th instant (page 142), there is a letter from J. H. B., stating that my improved Metronome was not new, and that the priority of invention belonged to a Mr. Heaton, of Birmingham. He certainly very nearly describes mine, differing only as to the number of wheels, mine having only four, and giving 2, 3, 4, 6, 8, and 9 beats in a bar. Your correspondent is not, however, very delicate in his insinuations, for he could hardly think I should so commit myself as to pretend and publicly to state myself to have invented that which he considers only a piracy. In reply, I have to inform him, that I never saw, heard of, or had the remotest knowledge whatever, that any similar improvement on Maelzel's machine had ever been made. It was a sudden thought, on my part, occasioned by the annoyance I had experienced, about two months since, by the continued stamping of the leader at an amateur concert, and I jocosely said, as I returned home, that I would invent an automaton conductor for him.

I remain, Gentlemen,

Your most obedient servant,

S. MEYDHAM.

AN INNOXIOUS FUEL.

GENTLEMEN;—The nuisance occasioned by volumes of smoke emitted from steam-engines, furnaces, and manufactories, is a source of general complaint and condemnation, and has even attracted the attention of the Legislature, who, to abate the evil, framed an act, making the consumption of smoke in such works compulsory, the non-consumption penal. Unfortunately the act is inefficient, the public being as completely now as before it was passed "involved with stench and smoke." Indeed it would appear, from experience, that the measure ordered by parliament to be effected is impracticable, and the principle upon which the act is formed erroneous. Instead of directing the mere counteraction of an evil arising from the consumption of a noxious fuel, the consumption of an innoxious fuel should have been enjoined.*

An innoxious fuel can be obtained, the production of which is peculiar to South Wales, and which is there called *stone-coal* and *culm*. In other parts of the United Kingdom it is called *Welch coal*. Its characteristics are, 1st, In a crude state, *extreme cleanliness;* it may be handled or carried in linen without soiling the fingers or cloth,—a qualification fitting it peculiarly for use in elegantly furnished apartments, museums, picture-galleries, &c. 2nd, A *great degree* of *indestructibility*, by reason of its composition having, in 50, 49 parts of carbon, and continuing in a state of active combustion for one-third of time longer than an equal quantity of the ordinary coal. 3rd, The *emission* of *intense heat*, generating one-third more of steam than the same quantity of coal now in use. 4th, In the best kinds, the *absence* of *sulphur*. 5th, In all varieties *entire freedom from bitumen*, and consequent NON-EMISSION of A PARTICLE of SMOKE. It is in fact VEGETABLE CHARCOAL.

Although under their proper denomination of stone-coal and culm, the minerals have not been extensively used in London, they have under the name of Welch coal been employed with considerable effect; while, in various parts of the country, by malsters and lime-burners, they have been for a considerable period extensively used. The former confine themselves to the stone-coal, and the latter to the culm, which is a mixture of refuse pieces, and of the produce of the stratum through which the stone-coal is approached, and to which it is inferior in quality and price.

The general introduction of these

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* We must take leave to enter our protest against the opinions here broached by our correspondent. The simple fact is, that the statute is not as generally enforced as it ought to be: for it is well known that there is nothing in the least "impracticable" in requiring smoke to be consumed. We gave, p. 121, Vol. I, a description of a Smoke-consuming Apparatus, invented by Mr. Brunton, and we have awaiting insertion the account of another, which has been found also very efficient, introduced by Messrs. Parkes and Son, of Warwick. Besides these, there were several other plans laid before parliament at the time the act was passed, which showed clearly enough, that smoke from manufactories is no necessary evil. Wherever people are annoyed from this cause, it is their own fault that they do not put the provisions of the law in force. A measure such as that recommended by our correspondent would have served the purpose of those who have an innoxious coal to sell amazingly, but it would have been establishing a monopoly in their favour as unjust as injurious to all other coal proprietors. Parliament did just what was required of it in ordaining that the lieges should no longer be smoked out of life and health, as they had been, leaving it to the burners of fuel each to adopt the means he might think best for abating the nuisance.—EDIT.

excellent and valuable minerals has hitherto been retarded by the difficulty of procuring a supply equal to the demand, and an apparent excess in the cost of them above the price of the ordinary coal. Yet as stone coal will burn one-third of time longer, and will generate one-third of steam more than the common coal, actually it is cheaper, and the use of it will not only cover the trifling expense which may be incurred in adapting existing furnaces to its consumption, but will occasion a considerable annual saving. Were it otherwise, the proprietors of offensive works had better endure such an additional outlay, than subject themselves to the recurrence of those penalties to which they are liable. To obviate the difficulty of obtaining a sufficient supply, extensive collieries have lately been opened in South Wales, capable of furnishing stone coal and culm, of the finest quality, to an extent commensurate with the largest possible demand.

In conclusion. The law declares smoke-vomiting to be illegal and penal, and fuel which burns free from smoke can be procured. If, then, the law remain a nullity, because not called into action; if the discharges of smoke be not reduced, the fault will rest with the public, who, having power, neglect to enforce the adoption of a remedy.

I am, Sir,
Your obliged Correspondent,
ANTI-FUMUS.

FIRE-ESCAPE.

April 23, 1824.

GENTLEMEN;—A few years back I observed an invention to escape the ravages of fire, exhibited outside one of the upper windows of a house in Picket-street, Strand. It consisted of a seat similar to those which are termed sociable seats. I saw a person get out, and after placing a loop of strong stuff, like webbing, under his arms, and throwing himself off the seat, he was gently let down to the pavement. I have no idea how it was accomplished, but think (if any of your readers are acquainted with this or any other method of escape from such danger, which often occurs, particularly in the metropolis), it may prove advantageous, by making it public. Your most obedient,

G. U. D.

EXTRAORDINARY BED-RIDDEN MECHANIC.

In the town of Alyth, in Scotland, there lately lived a man of much provincial celebrity, of the name of James Sandy. The originality of genius and eccentricity of character which distinguished this remarkable person, have been rarely surpassed. Deprived at an early age of the use of his legs, he contrived, by dint of ingenuity, not only to pass his time agreeably, but to render himself a useful member of society. He soon displayed a taste for mechanical pursuits, and contrived as a workshop a sort of circular bed, the sides of which being raised about eighteen inches above the clothes, were employed as a platform for turning-lathes, table-vices, and cases for tools of all kinds. His genius for practical mechanics was universal. He was skilled in all sorts of turning, and constructed several very curious lathes, as well as clocks, and musical instruments of every description, no less admired for the sweetness of their tone, than the elegance of their execution. He excelled, too, in the construction of optical instruments, and made some reflecting telescopes, the specula of which were not inferior to those finished by the most eminent London artists. He suggested some important improvements in the machinery for spinning flax; and was the first who made the wooden-jointed snuff-boxes, generally called Laurencekirk boxes, some of which, fabricated by this self-taught artist, were purchased and sent as presents to the royal family. To his other endowments he added an accurate knowledge of drawing and engraving, and in both these arts produced specimens of the highest excellence. This singular man had acquired, by his ingenuity and industry, an honourable independence, and died possessed of considerable property. From this brief history of James Sandy we may learn this very instructive lesson, that no difficulties are too great to be overcome by industry and perseverance, and that genius, though it should sometimes miss the distinction it deserves, will seldom fail to secure, unless by its own fault, competence and respectability.

COMBINATION LAWS.

The following is a copy of the Petition presented to Parliament from the Journeymen Smiths of London. We like it on account of its originality, for we would have every body of men to think and speak for themselves; and the sentiments, with a few slight exceptions, which we need not stop at present to discuss, are rational and manly.

To the Honourable the Commons of the United Kingdom of Great Britain and Ireland in Parliament assembled,

The humble PETITION of the undersigned JOURNEYMEN SMITHS OF LONDON,

SHEWETH;—That your petitioners are aggrieved by certain laws that have been passed from time to time against the combination and emigration of workmen, inasmuch as those laws have a tendency to deprive them of the fair use of the skill they possess, and of the fair remuneration they ought to receive for their labour.

That those laws are very injurious to the labouring classes; for, in consequence of the high and advancing price of provisions, and the want of employment for all ten hours a day, your petitioners and their families are reduced to a state of poverty and wretchedness unknown to their forefathers, who would have blushed to be paupers on the parish. We want not charity, but justice: the labourer is worthy of his hire.

That those workmen, among whom combination has been more perfect, have received a larger compensation for their labour than those among whom these means have been less perfect; yet there has for many years past been a gradual reduction in the wages of all, effected by the combination of the employers, who, if a man have the hardihood to resist their avaricious reductions, secretly transmit a note of character, and the poor man is from henceforth consigned to the parish, unless he can, by changing his name, or by travelling to a distance, evade their secret machinations.

That in the opinion of your petitioners, all laws which interfere with the wages of labour, are injurious to the general prosperity of the country; of vast and increasing injury to the working man, and of no permanent advantage to his employer; but that, on the contrary, all the parishes must be grievously taxed in poor-rates, to make up the deficiency of wages, and to no other end, than that the manufacturers and merchants may send cheap things to comfort and clothe the people of other nations; things which the labourers of this country produce, but are denied the use of, the wages of labour being so bad, that they cannot purchase the work of their own hands. The effects may be seen in the sister kingdom of Ireland at the present time.

That as there is no law to regulate the price of provisions, there should be no laws to prevent the working man obtaining ample remuneration for his labour.

That the agriculturist and manufacturer can put his goods aside, and borrow money from the Bank on their stock, and wait for the profitable price, but the labourer cannot put his labour aside, and borrow money. Time once past, is gone for ever to him.

That labour is of all things the most valuable. By labour all things are produced; but for labour the earth would become a dreary wilderness; and if the rich live to enjoy the produce of labour, the poor must have food to sustain animal life to enable them to undergo the great exertions of labour.

That we have produced sufficient to supply every demand; we implore you therefore to distribute them with the purest equity, or permit your petitioners to obtain remuneration for their labour.

That we may be tried by a jury before committal to prison, and not while there subjected to hard labour, like common felons.

That the origin of all laws is to protect the weak against the strong.

That the employers need no protection; for they are strong, and can starve the labourers into any terms. Your petitioners therefore earnestly implore your protection. We implore you to protect and save the industrious community from the all-powerful grasp of avarice and oppression, from degradation, from want and misery. We implore you in the name of that God before whose judgment-seat we must all appear and be judged of the good and of the evil.

Your petitioners, therefore, pray that your honourable House will cause inquiry to be made respecting the allegations contained in this petition, and other evidence which your petitioners are ready to adduce before the Committee of your honourable House, and that you will cause such alterations to be made in the laws complained of, as shall seem reasonable and just, and afford ample protection to the weak and indigent artizan and labourer, who in grateful remembrance will ever pray.

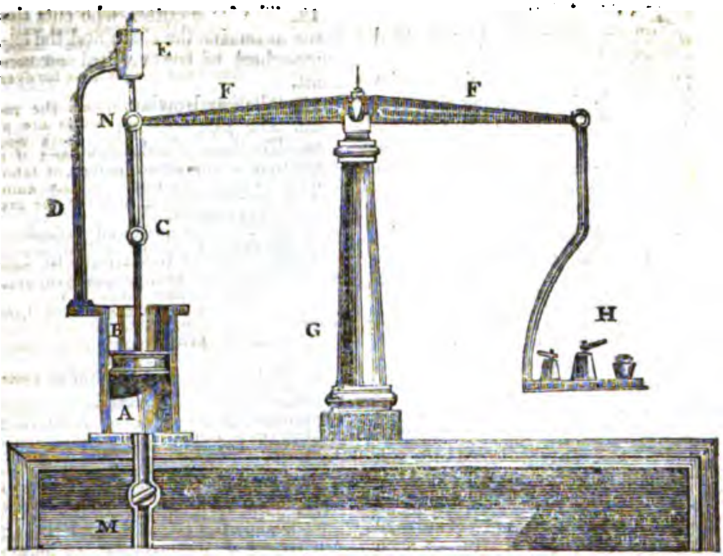
HINT TO BRICK-MAKERS.

GENTLEMEN;—On reading a treatise on brick-making in the Mechanic's Magazine, No. 33, by James Elmes, esq., the idea struck me forcibly, that tanners spent-bark might be applied very usefully in the burning of bricks. I believe it would be the means of keeping them of a light colour, and in many parts of the country the tanners would be glad to let the brick-maker have them for fetching away. W. R——y.

AIR-WEIGHING MACHINE.

London, Feb. 9, 1824.

GENTLEMEN;—You will perhaps insert in your useful miscellany the following engraving, and description of a machine for weighing the pressure of the common atmosphere.



A is a metal cylinder; B, a piston adapted to it; C, a joint; D, an arm from the cylinder, with a hole in it at E, which the piston-rod works through, and by which it is kept perpendicular; F F, a beam, which clips the piston-rod at the joint N, and is supported by the pillar G; M, a common cock; H, a scale, and weights attached to the beams.

Now, in order to ascertain the pressure of the atmosphere on the square inch, let the piston be first taken out of the cylinder, and as much weight placed in the opposite balance as will form an exact counterpoise: let the piston be then restored to its place, and a small quantity of oil and water (which has been previously weighed) be poured on the top of the piston, for the purpose of keeping it as air-tight as possible.

Open, now, the cock M, and push the piston to the bottom of the cylinder, so as to drive the air out. All then that remains to be done, in order to ascertain what pressure of atmosphere there is on the top of the piston, is to put weights in the balance till the beam becomes fair, making allowance always for the quantity of oil and water made use of to keep the piston air-tight.

The present machine the writer believes to be new, as he has never seen or heard of any thing similar, and he believes that it may be found useful to many of your readers.—Yours, &c.

A MECHANIC.

DIVISION OF LABOUR.

The following is a list of the workmen employed in manufacturing a watch-movement previous to its coming to the hands of the London watch-maker:—

1. The frame-maker.

2. The pillar-maker, who makes the pillars and studs.

3. The cock-maker.

4. The maker of the barrel, great wheel, and fuzee, with their parts.

5. The going fuzee-maker.

6. The centre-wheel and pinion-maker.

7. The small pinion-maker, who makes it of wire called pinion-wire, the 3rd and 4th wheels and escapement wheel-pinion.

8. The small wheel-maker, who makes the 3rd and 4th wheels, and rivets them to their pinions.

9. The wheel-cutter.

10. The verge-maker (for vertical watches).

11. The movement finisher, who turns the wheels of a proper size previously to their being cut, forwards them to and receives them from the wheel-cutters, and finally completes the movement, and puts it together.

12. The balance-maker.

13. The pinion wire-drawer, who prepares the pinion wire.

The movement, in the state in which it is sent to the watch-maker, consists of the frame, composed of two plates, connected together by four or five pillars; these pillars are riveted to the pillar-plate, and to the great wheel attached to the fuzee, the centre wheel, the 3rd and 4th wheels, the fuzee and barrel, the potance and stop-work.

The following is a list of workmen to complete a watch from the state in which the movement is received from the country:—

1. The slide-maker.

2. The jeweller, who jewels the cock and potance.

3. The motion-maker, who makes the brass edge joints, and locks the watch in the case, and makes the motion-wheels and pinions.

4. The wheel-cutter, who cuts the motion-wheels for the motion-maker.

5. The cap-maker.

6. The dial-plate-maker.

7. The painter of the dial.

8. The case-maker.

9. The joint-finisher.

10. The pendant-maker.

11. The engraver, who engraves the name of the watch-maker on the upper plate.

12. The piercer, who peirces the cock and slides for the engraver, and afterwards engraves them.

13. The escapement-maker, who makes the horizontal duplex; but the escapement of a vertical watch is made by the finisher.

14. The spring-maker, who makes the main-spring.

15. The chain-maker.

16. The finisher of the watch, and who makes the pendulum-spring, and adjusts it.

17. The gilder.

18. The fuzee cutter, who cuts the fuzee to receive the chain and the balance-wheel of the vertical escapement.

19. The hand-maker.

20. The glass-maker.

21. To these must be added the pendulum-spring wire-drawer.

The above number of workmen, being thirty-four in all, are employed in making a plain watch; and a repeater requires the whole of the above, with the aid of several others.

DYMOND.

SQUARING WOOD.

Dartford.

GENTLEMEN;—I have before now puzzled some who could handle a plane well, in wagering a trifle that they could not plane an exactly square piece of wood; that is, to answer the square *all round*, a thing I never saw done. But a cube can be made upon a common turning lathe, which will take the square every way. This information may be useful to some of your readers, and amusing to others.

J. J.

MICHAEL ANGELO BUONAROTTI.

Bungay, April, 1824.

GENT.;—During a tour on the continent, I passed through the small, but handsome town of Breda, in the *ci-devant* Duchy of Brabant. Of the palace which King Charles II. inhabited during the interregnum, no traces exist, to show at least that it was the residence of the exiled monarch; of its moat and gardens the site only remains, and the building is now used as an hospital for the sick. The church of St. Barbara boasts a beautiful spire, and the nave contains a brass font wrought in exquisite style.

But there is one piece of monumental sculpture worthy the study and attention of the artificer and traveller; the work of one of the most renowned artists Italy produced, and who flourished during that brilliant period (from the close of the 15th to the close of the 16th century), when sculpture and the sister arts were in their "most high and palmy state," and might almost be said to rival the productions of ancient Greece and

Rome, I regretted that my slender knowledge of penciling disqualified me from giving any adequate representation of this admirable work. Had I possessed a drawing, or print of it, I should with pleasure have sent it to you, to illustrate the following account, should it be deserving a page in your useful Magazine.

I am, Gentlemen,
Your most obedient servant,
T. U.

MONUMENT

OF COUNT ENGELBRECHT OF NASSAU, IN THE GREAT CHURCH AT BREDA.

In the chapel of the Holy Virgin Mary, or the choir of the Lords of Breda, is to be seen the elegant monument of Engelbrecht the second, Count of Nassau, and his consort Limburga of Baden, erected by order of Henry Count of Nassau, in honour of Engelbrecht, his uncle and benefactor. This monument is chiefly composed of alabaster, or transparent oriental marble, and was made by the celebrated artist and statuary *Michael Angelo Buonarotti*. It consists of two statues, the Count and his consort, in a recumbent position, on a raised tomb of Lapis Lydius, or touchstone. Above them is a table, likewise of touchstone, elevated by four supporters, each of them kneeling on his right knee; and upon the table is displayed the armour of the Count, and the emblems of his dignity wrought with superior skill in fine white marble. A square alabaster plate is affixed beneath each of the supporters; the inscriptions on two of them are perfect, but the others are entirely obliterated.

The first of these supporters represents Julius Cæsar in Roman armour, with the following inscription:—

C. JULIUS CÆSAR.
VIRTUTE BELLICA IMPERAVI—
FORTITUDO.*

The second supporter represents the famous Roman General Regulus, the upper part of whose body is quite naked. The prominence of the muscles, and the general *couleur* of the figure is expressive of uncommon strength, beneath which the following inscription is to be found:—

M. ATTILIUS REGULUS.
FIDEM INFRACTUS SERVAVI—
MAGNANIMITAS.*

The two other supporters whose inscriptions are destroyed, appear to be two Grecian heroes (probably Achilles and Ulysses); it is visible, that the martial dress of these two statues has formerly been gilt. At the base of the tomb, on the south side, are the escutcheons of the Count, and on the north, those of the Countess, without inscriptions. Excepting the defacement of the plates and letters,† the monument is in good preservation; every part of it is exquisitely delineated, and discovers the masterly genius which distinguished the productions of that eminent sculptor.

* "*Caius Julius Cæsar*. I have governed by martial valour—Fortitude."

* "*Marcus Attilius Regulus*. I never violated my once-given word—Magnanimity." Regulus after many victories in Africa, was made prisoner by Xantippus, and detained at Carthage. He was deputed by the Carthaginians to Rome, to propose peace, previously promising to return again. To this circumstance the Motto most probably alludes.

† It appears not to have been the hand of time, but violence that caused this. The writer of this was assured by an inhabitant of Breda, that during its last occupation by the French, a number of foreign infantry were awhile quartered in the church and to them it was attributed

ABERDEEN SCHOOL OF ARTS.

Castle-street, Aberdeen,
March 17, 1824.

GENTLEMEN;—In consequence of a reference to the Aberdeen Mechanics' Institution, in the 27th Number of the London Mechanic's Magazine, and a request from you to some anonymous correspondent for a copy of the laws of the Aberdeen School of Arts, I have been authorized by the Committee, in order to prevent misrepresentation, to send you, along with the laws, a brief statement of the rise and progress of the Institution, which, but for some unpleasant proceedings that took place at the formation of the Mechanics' Institution, might never have been heard of.

To these proceedings, of which enough has been said at home, we feel no inclination to recur. It is sufficient to say that they were such as met with the unqualified disapprobation of many intelvidual individuals, and the consequence was, that

On the 16th of Feb. 1824, a meeting of a few friends was held, to take into consideration the propriety of establishing what notwithstanding the formation of the Mechanics' Institution, was yet a desideratum in Aberdeen,—an Institution for Promoting the Knowledge of the Arts and Sciences among Tradesmen and others, *on such liberal terms as would secure to all concerned an equality of privileges, and completely preclude any feeling of disrespect towards any class of its members.*

The proposal met with the cordial approbation of all present, and their sentiments were embodied in the following resolutions, which were laid before two subsequent meetings, at the latter of which a Committee was appointed to draw up a set of regulations for the Institution.

I. That this meeting, viewing with interest the rising respectability of tradesmen, mechanics, and artisans of every description, are of opinion, that a general knowledge of science, in every branch connected with Natural Philosophy, would be of incalculable advantage, and recommend the formation of an Institution for the promotion of this object.

II. That for its attainment they recommend that a Library be established, consisting of works on Science and general Literature; and that Lectures be procured on the various branches of Natural Philosophy, as extensively as the funds will permit.

III. That a subscription of ten shillings per annum, payable by quarterly instalments, shall entitle the subscriber to all the advantages of the Institution.

IV. That the management of the Institution be under the entire control of its members, who shall elect annually a Committee of their number to conduct its affairs.

On the 17th of February the Committee appointed to draw up regulations for the Institution, commenced their labours; and, after several sittings, at which there was much discussion on the various subjects that were brought forward, and a rigid examination of every clause of the regulations, it was unanimously agreed to recommend the following as the fundamental laws of the Institution:—

[The scope of these laws, which it is unnecessary to give at length, is in the highest degree liberal, and proves most satisfactorily that there is no ground whatever for the charge made by our anonymous correspondent, that the Society was formed on an exclusive system. The object of the Institution is said to be "for Promoting scientific Knowledge *among all Classes of the Community;*" the Committee in whom the management is vested, are directed to be chosen from among the members of the Institution indiscriminately, and "*irrespective of their trades or occupations.*" The following rules are peculiar, at least as contrasted with our Institution in London, and, in our opinion, well worthy of imitation:—

"Those who have been five years full-paying members of the Institution, shall for the next five years be entitled to all its privileges, on paying six shillings per annum, and thereafter, during life, they shall be entitled to the same on paying five shillings per annum; but this right shall not be transferrable."

"The President and Committee shall have power to call any extraordinary meetings of the members that they may think necessary, *and shall be bound to call general meetings on requisition of twenty members of the Institution, who, on refusal of the Committee, shall have power to call such meetings themselves.*"

"That although the Lectures shall in the first instance be chiefly on Chemistry and Mechanics, they may be extended afterwards, as the funds may admit, to such other branches of science as may be decided on by a majority of the members present at a meeting regularly called for the purpose."—Edit.]

The foregoing regulations having been laid before a general meeting of the members, held on Monday, 1st March; they were cordially approved, and unanimously adopted as the laws of the Institution.

At a subsequent meeting it was agreed that the advantages of the Institution should be extended to apprentices above fifteen years of age, recommended by members, at the rate of five shillings per annum; but that, not being considered full members, they should have no share in the management.

It was also agreed that the same advantages should be extended on the same terms, for the space of two years, to young men learning a business *without indenture.*

I have only to add further, that on Wednesday, 10th current, the election of the Committee took place, and that on Friday the 12th current, the Committee elected the President, Vice-President, Treasurer, and Secretary, and transacted some general business. Our numbers are increasing daily, and as soon as we can find a suitable Lecturer on Chemistry, our operations will commence.

I am, Gentlemen,
With much respect,
Your most obedient servant,
DAVID MACALLAN, Sec.

ANSWERS TO INQUIRIES.

STEAM-NAVIGATION.

GENTLEMEN;—It will afford me pleasure if, through the medium of your excellent Magazine, I throw some light on the question proposed by E. S. C., in page 381 Vol. I. and which Mr. Henry Deacon, and perhaps many of your readers, still find it difficult satisfactorily to resolve. I would, however, premise, that as it is one of those questions, the correct solution of which cannot be obtained in the present imperfect state of our knowledge of the manner in which fluids act, the elucidation must rest on the hypotheses admitted in most of the theories of the resistance of fluids, and therefore will not be quite correct in practice.

When it is said that the influence of the steam causes the vessel to move six knots an hour, we understand that the effort of the steam just overcomes the resistance which the vessel experiences when impelled at that rate; and if we suppose the velocity of the vessel to be increased by an adventitious force, such as that of the wind on the sails, still the operation of the engine will remain the same; that is, it will now move with a greater velocity against a proportionably less resistance on the paddles; and therefore, its influence in moving the vessel forward will continue unaltered. We have omitted, of course, the inertia, &c. of the machine, as well as the small difference of momentum which may arise from the increased velocity with which the fluid is brought into contact with the paddles.

With respect to the force of the wind on the sails, which, when it acts alone, will move the vessel six knots an hour, it is easily seen, that if another force, as that of a steam-engine, be added, this, by propelling the vessel with increased velocity, will cause the sails to be less violently acted on by the force of the wind. This diminution of the pressure on the sails, may be estimated, on the supposition that the resistance of a fluid on a surface varies as the square of its velocity, by putting n to represent the velocity of the wind, and x for the increase of the vessel's velocity, when wind and steam act together. We shall then have the force of the wind on the sails (when the wind acts alone) represented by $\overline{n-6}^2$; and this force impels the vessels six knots an hour. The force of the wind on the sails, when wind and steam act together, will be expressed by $\overline{n-6x}^2$; and this force impels the vessel x knots an hour. Hence, when wind and steam act conjointly, the vessel's velocity is $n+x$ knots an hour; n knots are caused by the steam-engine, and x knots are produced by the wind. The value of x is afforded by the proportion $\overline{n-6}^2 : \overline{n-6-x}^2 :: 6 : x$; where n is a given or known quantity. If $n = 36$, x will be $= 4·4$, and the vessel's velocity, 10·4 knots per hour.

Your most obedient servant,
W. H.

No. 3.—SIZING OF PAPER.

The best engine sizing for paper I know of, is two gallons of the clearest parchment size, put into the engine when heated to 150 degrees of Fahrenheit; and adding thereto, after running one hour, four quarts of clear water, in which four ounces of Aleppo galls have been boiled.

AN OLD PAPER-MAKER.

N. B.—The finer the rags, the better the sizing.

No. 11.—ELECTRICITY OF PAPER.

The adhesion of a sheet of paper when heated, and briskly rubbed with Indian-rubber, arises from an electrical effect produced by the friction, both these substances being strong electrics. The paper, after being excited, and thereby charged with electricity, seeks to discharge it by attaching itself to any electrical conductor. If your correspondent will try the experiment of applying the paper to a sheet of glass, he will find that no adhesion will take place, because glass is itself an electric, and not a conductor of electricity. R. C. is wrong in saying that friction alone will not produce the effect, which it will do, though in so slight a degree as perhaps not to sustain the weight of the paper. The way in which heat produces a stronger effect, depends chiefly on its making the paper drier, moisture being as great a conductor of electricity. When the paper is damp, it will not retain its electrified state so long, nor will so great a quantity of the fluid be accumulated, as it will be conducted away almost as soon as produced, even during the application of the Indian rubber.

Your obedient servant,

H. B.

No. 12.—SMOKING HAMS, &c.

In answer to Mrs. Dirpe's inquiry as to "the best method and *material* of fuel to be used for smoking hams, beef, &c. calculated for family purposes, and kitchen practice," allow me to say, that in our family we cure these essential articles by means of the *concentrated rough* pyroligneous acid. The flavour thus obtained is more delicate, the meat less liable to become rancid, and the sacrifice of a few minutes produces all the effect of the more protracted and less convenient or cleanly method of smoking.

Process.—Salt your meat in the usual way, taking care to rub the salt well in, and to turn the meat in the brine once every day. At the end of three or four weeks, hang up the meat to drain for twenty-four hours; then with a brush, such as is used for oiling harness, dipped in the concentrated rough pyroligneous acid, smear the meat well all over, and hang it up in an airy, dry place.

I find one application of the acid sufficient, but a second or third will produce a more powerful Westphalia flavour.

It is a maxim, that the only proof of the pudding lies in the eating; hence this note is accompanied by a sample of bacon cured in October last, precisely according to the foregoing receipt.*

I am Gentlemen,

Your obedient servant,

A Bacon-Fed Chuff.

INQUIRIES.

No. 14.—CYCLOIDAL CHUCK.

Gentlemen;—In the 8th Number of the Mechanic's Magazine is given a plate of the Eccentric Chuck; the construction, I have been in the habit of using this; but there is another chuck, which, if any of your readers will furnish a description of, I shall feel obliged—I mean the Cycloidal Chuck. I presume that the principle of its action must be the same as that of the Geometrical Pen; but as I have never seen one, I am at a loss as to its construction.

Yours, &c.

Agrones Hagmio.

No. 15.—THE BEST CEMENT FOR TURNERS?

I have used the receipts commonly given, of pitch, bees'-wax, rosin, &c. mixed with sand, and also with red ochre, but with very bad success. A. H.

No. 16.—DEPOSIT IN STEAM-BOILERS.

Gentlemen;—I have a steam-boiler for the application of heat in constant use, in a situation where the water contains a large quantity of lime and other mineral matters. By the constant evaporation of the water these matters accumulate in the boiler, and soon form a very thick crust or deposit on the bottom and sides of the boiler. As this prevents the heat from reaching the water so soon as it otherwise would do, and thereby fuel is wasted, and the bottom of the boiler sooner burnt and worn out, I have been in the habit of chipping off the earthy deposit from time to time. It is, however, a tedious operation, and likely to injure the boiler. I should feel obliged to any of your correspondents who could inform me of some method of avoiding this inconvenience, whether by separating from the water the earthy matter held in solution before introducing it into the boiler, or by putting into the boiler some substance which should remain at the bottom and receive the deposit, without at the same time defending the water too much from the action of the fire, and which might be removed with more facility than the earthy crust, which requires a hammer and chisel to cut it off.

Your obedient servant,

H. B.

LINEN AND COTTON SPINNING IN FRANCE.

M. Charles Dupin, in a discourse lately delivered on the progress of French industry since the commencement of the

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* We have made trial of the sample, and found it to be indeed most excellent. Remembering, as in duty bound, the fair inquirer on the subject, we have left at 24, Pater-noster-row, a moiety of the specimen, addressed to Mrs. Dirpe, which we request may be sent for, that she too may have "proof of the pudding." Another correspondent (G. B.), informs us, that those in the trade always use oak for the purpose of drying bacon or hams, as it is considered to communicate a peculiar flavour.—*Edit*

nineteenth century, relates some facts deserving of notice. Alluding to a proposition to offer a prize of a million francs to the mechanician who should invent a mode of spinning linen of the same degree of fineness as is attained in that of cotton, he remarks, that if this prize had been maintained, the amount of the recompense would have undoubtedly led to the attainment of the object so much desired, notwithstanding the difficulties which the solution of such a problem presents. The spinning of hemp and linen by mechanism, he remarks, although far from perfection, has made remarkable progress: being first used in England and Scotland for the coarsest cloths, such as sailcloth, it has been particularly improved since the peace of 1814, so as to be applied to finer fabrics. This improvement has been introduced into France, and there are several manufactories where it is used with success. One at Oreil, in the department of the Seine and Oise, is particularly cited.

Considerable improvement, he says, has been made in the weaving of sail-cloths, and the French imitate, successfully, those of Holland and Russia. The manufacture of damask table linen has been also successfully introduced into France. At first, it was made only by means of machinery, which was to be found no where but in Silesia. When the French conquered Prussia, the minister of the interior procured to be brought from that country a model of the looms used in Silesia, with a workman acquainted with the manner of setting them up, and working them. These were deposited at the conservatory, where pupils were regularly instructed in the weaving of damask cloths. This kind of industry soon spread from one extremity to the other of France. In 1823 still further improvements were made, and damask cloths of beautiful designs and remarkable fineness and evenness, were woven, of three and two thirds metres, or about four yards in width.

A still greater progress, we are told, has been made in the manufacture of cotton fabrics. In this branch of industry, the English were in advance of the French, full thirty years, viz. from 1770, when Arkwright set in motion his mechanism for spinning cotton, to 1800, when the French began this species of manufacture. The French government offered it great encouragements. They invited artists from Great Britain, capable of building the machines, and deposited these at the conservatory at Paris, and in the principal towns, where they might be studied and imitated. The success of these measures was so rapid, that, in 1806, the Judiciary of the Exhibition declared, that, for the future, it was necessary to offer encouragements only to the spinning of numbers of a fineness exceeding 60.—From that period, the French establishments produced threads fine enough for the making of the most beautiful muslins. At the exhibition of 1819, they presented threads of all degrees of fineness, from No. 120 to 200. To give an idea of the tenuity which these numbers indicate, he remarks, that a kilogram of cotton (2 1-5 lbs.), spun to the number 200, and extended, in a right line, would measure 400,000 metres (about 260 miles) in length, and that a pound of cotton, spun to the same number, would inclose seven times the city of Paris, supposing it to be seven leagues in circumference.

Since that period, great improvement has been made in the rapidity, and economy of time and material, in the spinning of these threads, and also in the strength and evenness of the fabric. No improvement has been made in the machinery used, but greater skill has been acquired in the application of it. In the towns of St. Quentin, cotton manufactories were established in 1803. This place was, formerly, the centre of the manufacture of cambrics and lawns; but these, having gone into decay, the weaving of cotton found many workmen there suited to this kind of labour. In consequence of the introduction of this new branch of industry, the town rapidly increased, and it now numbers 15,710 inhabitants. In 1803 the town of Tarare manufactured only coarse cottons of a very common quality: it now produces muslins, which are said to rival the most perfect that India can offer. The labour of this manufacture, which is introduced into the mountains of Beaujolais, is performed by the families of farmers, at seasons of the year, and at moments when they are not employed in the labours of the field.

France, in 1800, imported 9,945,000 kilograms of cotton. In 1811, notwithstanding her increase of territory, only 8,266,000 kilograms; but, in 1822, reduced to her ancient limits, 21,572,190 (about 180,000 bales.)

STINGLESS BEES.

(*From Captain Hall's Journal on the Coast of Chili, Peru, and Mexico*).

From the Plaza, we went to a house where a bee-hive of the country was opened in our presence. The bees, the honey-comb, and the hive, differ essentially from those in England. The hive is generally made out of a log of wood, from two to three feet long, and eight or ten inches in diameter, hollowed out, and closed at the ends by circular doors, cemented closely to the wood, but capable of being removed at pleasure.

Some people, instead of the clumsy apparatus of wood, have a cylindrical hive, made of earthenware, and relieved with raised figures and circular rings, so as to form rather handsome ornaments in the veranda of a house, where they are suspended by cords from the roof, in the same manner that the wooden ones in the villages are hung to the eaves of the cottages. On one side of the hive, half way between the ends, there is a small hole, made just large enough for a loaded bee to enter, and shaded by a projection, to prevent the rain from trickling in. In this hole, generally representing the mouth of a man, or some monster, the head of which is moulded in the clay of the hive, a bee is constantly stationed, whose office is no sinecure; for the hole is so small, that he has to draw back every time a bee wishes to enter or to leave the hive. A gentleman told me that the experiment had been made by marking the sentinel, when it was observed that the same bee continued at his post a whole day.

When it is ascertained by the weight that the hive is full, the end pieces are removed, and the honey withdrawn. The hive we saw opened was only partly filled, which enabled us to see the economy of the interior to more advantage. The honey is not contained in the elegant hexagonal cells of our hives, but in wax bags, not quite so large as an egg. These bags or bladders are hung round the sides of the hive, and appear about half full, the quantity being probably just as great as the strength of the wax will bear without tearing. Those near the bottom being better supported, are more filled than the upper ones. In the centre of the lower part of the hive are observed an irregular shaped mass of comb, furnished with cells like those of our bees, all containing young ones in such an advanced state, that when we broke the comb and let them out, they flew merrily away. During this examination of the hive, the comb and the honey were taken out, and the bees disturbed in every way, but they never stung us, though our faces and hands were covered with them. It is said, however, that there is a bee in the country which does sting; but the kind we saw seem to have neither the power nor the inclination, for they certainly did not hurt us, and our friends said they were always "muy manso," very tame and never stung any one. The honey gave out a rich aromatic perfume, and tasted differently from ours, but possessed an agreeable flavour.

NEW PATENTS.

To John Lingford, of Nottingham, lace-machine manufacturer; for certain improvements upon the machines or machinery now in use for the purpose of making that kind of lace commonly know or distinguished by the name or names of bobbin-net, or Buckinghamshire lace-net.—Dated March 20, 1824—six months.

TO CORRESPONDENTS.

G. J. B. will hear from us soon on the subject of his first interesting communication.

We shall examine into Nathan Copcake's case; let him not be cast down; one of his papers at least is among those intended for insertion.

If B. N. will cause the model he speaks of to be left for us at our Publishers, it shall be submitted to the examination of competent judges, and every care taken of it.

We shall try to find room for W. W.'s paper next week.

Communications received from Nicol Dixon.—W. H.—John Peck.—John C. S.—A Goldsmith's Apprentice.—R C. Barrett.—W. K. S.*****—J. Bennet.—Dædalus.—R. E.—G. M. H——n.—W. S. C.—Lemage.—H. W. Hudson.—A Friend.—An Original Subscriber.—W. L.—E. D. B.—I. B.—Valentine.—F. H.—A Member of the Society of Arts.—H. S.—A.B., Wellingborough—Valentine.—E. Nixon.—A. B. St. Pancras.—John Morton.—A Shipwright.—T. K.—Simon Cutwell.—X.—and Mechanicus.

Communications (post paid) to be addressed to the Editors, at the Publishers.

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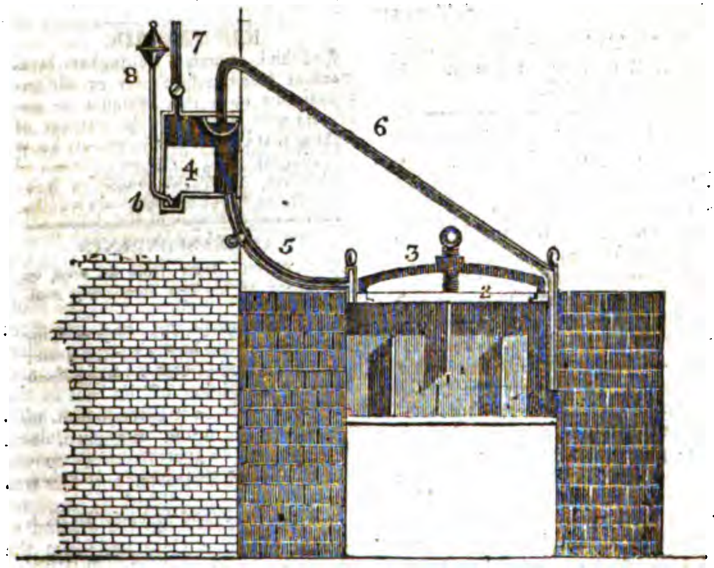
Mechanic's Magazine,
Museum, Register, Journal, & Gazette

.... What though not all
Of mortal offspring can attain the heights
Of envied life; though only few possess
Patrician treasures, or imperial state;
Yet Nature's care, to all her children just,
With richer treasures and an ampler state
Endows at large whatever happy man
Will deign to use them.—*Akenside.*

No. 40.] SATURDAY, MAY 29, 1824. Price 3d.



IMPROVED FAMILY OIL-GAS APPARATUS.

Fig. 1 is a retort (made in the form of a back for a kitchen range or other fire-places), intersected with perpendicular partitions, so as to create a greater extent of surface for the gas to pass over, which will greatly promote the purification of it.

Fig. 2 is a lid to allow the cleaning of the retort, secured by a bar across the top fig. 3.

Fig. 4, a close cistern containing oil.

Fig. 5, a pipe leading from the cistern to the retort, having a regulating cock.

Fig. 6, a pipe connecting the opposite end of the retort with the top of the cistern, and furnished inside with a small cup full of oil, about four inches deep, into which the end of the pipe is inserted, to prevent the return of the gas while the retort is cleaning.

Fig. 7, a pipe to convey the gas away when formed.

Fig. 8, another pipe, with a funnel to supply oil from time to time, having the lower end inserted in the sunk end of the cistern *b*, by which means the gas will be prevented from escaping, should the cistern by any accident be left to empty.

This apparatus will not require an extra fire. Should any oil escape in the form of steam, it will be condensed, and return to the retort again to undergo decomposition. By the recesses in the cistern it will be impossible for the gas to escape into the room without having first passed to the gasometer, which may stand in any convenient place.

It is calculated that one gallon of whale oil will make 100 cubic feet of gas, which, at 2*s.* per gallon, and allowing 1*s.* for expences and interest, will make 3*s.* per 100 feet, or about 2½*d.* for a light, equal to that obtained from 1 lb. of candles.

S. Trulon.

P. S.—To increase the effect of the retort, it may be filled with coke or old pieces of brick.

MR. PERKINS' STEAM-ENGINE.

We have before us a pamphlet which Mr. Perkins has printed for private distribution, for the purpose chiefly of stating the practical results which he has ascertained during his experiments on the steam-engine. It appears, that many years ago Mr. P. was satisfied, from some facts which he had observed relative to steam of high expansive force, as employed in America by the late Mr. Oliver Evans, that making use of steam merely to form a vacuum, for the purpose of using atmospheric pressure, was not taking all the advantage which that extraordinary agent possessed. When he reflected upon the almost infinite power that is sometimes displayed in the eruptions of Mount Vesuvius, throwing up incalculable masses of matter into the very clouds, he was induced to consider how this immense power could be generated. "How is it that this power is so wonderfully great? Is it not high elastic steam?" The thought struck him that it must arise from the water being confined by pressure until it became sufficiently charged with heat to enable it to rend asunder whatever confined it. The tremendous power of steam is frequently rendered evident in iron foundries: if by accident a drop of water has found its way into the mould, the steam there generated has sometimes caused an explosion that scattered the fluid metal in a shower to a considerable distance, and even carried it through the roof of the foundry; yet a thousand times that quantity of water thrown *upon* the heated metal would be perfectly harmless.

Mr. P., accordingly, was induced, soon after he came to England, to turn his attention to the subject, and at first intended to follow up the ideas of Mr. Evans, relative to high pressure, and to do that which the imperfections of workmanship in America had prevented Mr. E. from accomplishing, being fully convinced that the exertion of power in the steam increased in a very different ratio to the quantity of fuel consumed.

Such being the case, it became evident that the higher the steam the greater the economy of fuel. But in pursuing the subject, it occurred to Mr. P. that much of the conducting power was lost by *steam being formed at the bottom of the boiler*, which is the case when ebullition begins; and it frequently happens that the ebullition is so great as to form one sheet of steam at the bottom of the boiler, which bottom becomes red hot, and instead of giving off its heat to the water, desperses it by radiation. To prevent ebullition, therefore, and compel the water to take up the heat, seemed desirable, and this was only to be accomplished by pressure, that is, by confining the column of water within a close vessel, in the manner described in Mr. P.'s specification.

Mr. P. remarks, that another very considerable loss of heat is sustained by the condensing apparatus commonly employed, in which, out of 1170 degrees of heat absorbed in generating the steam, 1070 are absolutely lost by entering into the condensing water. To arrest as much of this heat as possible was the next object of Mr. P., and in effecting this, much time has been expended, and many experiments have become necessary, though finally so complete has been the success of the experimentalist, that nearly *"all the heat has been absorbed from the steam, and returned to the generator."*

There is also more loss of heat occasioned by the common mode of supplying air to the furnace than is generally supposed. To prevent the escape of heat up the chimney, which necessarily takes place when combustion is effected by draft, Mr. P. has adopted a plan for "*forcing* the air into the furnace, which is so constructed as to have the air pass over its heated surface, thereby taking with it the radiant heat." This mode of forcing the air in at the top of the furnace, not only causes the smoke to be consumed, but renders the fire hottest at top. By this contrivance no smoke will be emitted, to annoy the passengers of steam-vessels, nor will the massive iron flues be necessary, which, in the event of head winds, impede the progress of the vessel, as the outlet of the flue may be contracted to *one-fiftieth* part the usual size, and may be conducted off even under the water.

Mr. P. then gives a sketch of the circumstances which led to the invention of the improved steam-engine. Its novelty consists, first, in generating steam from water confined by mechanical pressure, the water being thereby prevented from boiling; secondly, in condensing the steam without employing more water than is required to supply the generator.

"It is a well-known fact, that water does not boil under atmospheric pressure, until it has been heated to 212°; after which, all the heat that can be applied cannot increase the temperature of the steam or water. Now add an artificial atmosphere, by loading the escape valve (the surface of which is equal to a square inch) with 14lbs., and it will receive 250° of heat with a very little addition of fuel, and the pressure on the square inch will be doubled, or 28 lbs.; though the mechanical action will not be double, yet it will be increased much more than the consumption of fuel. Let the valve be loaded with two additional atmospheres, or 42lbs., and the temperature will be raised to 280°, and will again produce double pressure, or 56 lbs. on the inch, and so on. If the generator be made strong enough (as I have no doubt it may be) to withstand 60,000lbs. load on the escape-valve, the water would not boil, although it would exert an expansive force equal to 56,000lbs.* on the inch, and be at about 1170 degrees of heat, or cherry red. Water thus heated would, if it were allowed, expand itself into an atmospheric steam without receiving any additional heat from what surrounded it. It is not, however, necessary to heat the water to more than about 500 degrees to have it flash into steam, if the generator be properly constructed. I have tried several modifications: the last (which will be more particularly described), I have found much the best. The first form of generator, although not the best, served to evince the fact which was contemplated, viz. that of heating water in a generator completely filled, and under sufficient pressure to prevent ebullition; and yet as it passed from the generator to the cylinder, to flash into steam, although it had received 600 degrees of heat, or thereabouts, in addition to what it already contained, before it became steam."

SOCIETY OF ARTS.

Gentlemen;—Having had occasion lately to see some operative weavers on the subject of improvements in silk machinery, I was surprised to find that a notion generally prevailed, that considerable interest is requisite to procure the admission of inventions to be submitted for the consideration of the Society of Arts, with a view to being rewarded by that Institution. As it is probable that this opinion may prevail amongst ingenious workmen in other trades, I think you might do an essential service if you were to inform your readers, that no interest or patronage whatever is necessary, and that all that is required of the candidate is, that he send a letter, addressed to the secretary, A. Aikin, Esq. Adelphi, announcing the subject, which letter should be accompanied by a model, or de-

* It is supposed that 56,000 lbs. or thereabouts, to the square inch, is the limit to the power of steam; so that if the generator was strong enough to sustain a pressure of 60,000 lbs. it could not be exploded.

scription of the invention; but this is not absolutely necessary. The candidate may, if he please, state, that when called upon, he will be prepared to wait upon the Society to produce his invention. In due time a letter is written to the candidate, announcing that his invention has been referred to a committee, and informing him on what day it will be taken into consideration. The Society is open at all times to receive inventions, but they can only be considered during the session, which commences early in November, and concludes on the second Wednesday in June. It may be useful to add, that the list of premiums is published early in June, of each year, and that they may be had gratis, at the house of the Society, on application to the porter, between the hours of ten and two.

A MEMBER.

CAPTAIN MANBY.

[Captain M. is undoubtedly entitled to the full degree of praise to which he lays claim in the following letter. It is not to be denied, that by his persevering assiduity in improving Lieutenant Bell's invention, and bringing it into extensive use, he has conferred a national benefit, which well merited a high reward.—EDIT.]

Yarmouth, May 16, 1824.

GENTLEMEN;—In reply to the very uncandid remarks made on the plan for "furnishing assistance to the crews of vessels wrecked," in the 30th Number of your Magazine, I feel myself called upon to deny the assertion stated, "of taking credit" for the invention: I am, however, induced to hope, that no candid person will refuse me that of author, from my being the first individual who practically brought such mode of assistance into use, who first saved life by it, and who has been instrumental in the preservation of 278 persons by such plan.

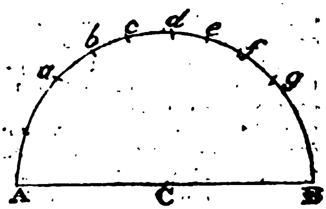
It is painful to state any circumstances that may take from the fame of a deceased meritorious character; but your remarks extort the following observation, that Lieutenant Bell never saved a single life by his plan; nor was it practicable in a storm on the ocean.

I am, Gentlemen,
Your very humble servant,
G. W. MANBY.

EXPERIMENTS ON LIGHT AND COLOURS.

Lincoln, April 22, 1824.

GENTLEMEN; — The following method of mixing and combining the colours of light occurred to me about two years ago; and as I perceive you sometimes admit papers on similar subjects in your Magazine, I submit it for insertion. I am not aware that a similar method has been pointed out by any writer on the subject.



To a piece of board, A B, about eighteen inches long, and twelve inches broad, let there be fastened a piece of paste-board, or some other convenient material, of the same breadth, so as to form a semi-circle to the radius A B. Let there be made seven circular holes, as *a*, *b*, *c*, *d*, *e*, *f*, *g*, in the semi-circular part, each about an inch in diameter, having a groove, or some other contrivance, inside, to hold a piece of coloured glass, so that it may be removed or changed at pleasure. In the centre of the board A B, let there be a hole, C, about two inches in diameter, which must be covered with ground-glass. Having covered the holes in the semi-circular part with pieces of glass, of the several colours of the prismatic spectrum, place a lighted candle before each, in the direction of the radius, at equal distances from the centre C, and the light transmitted through each glass from its corresponding candle, will fall on the ground-glass, in passing through which the several colours will be so completely blended, that to an eye placed on the other side, among the diverging rays, it will appear colourless, or such as would be produced by a single candle, without the intervention of coloured glass. By stopping the rays of any one candle, the colour resulting from a combination of *all the rest* will appear, and by removing any of the candles to a greater or less distance, a greater or less portion of the corresponding colours will be thrown into the composition, and thus, an almost infinite variety of the most beautiful tints may be produced; and as the intensity of light is always inversely as the square of the distance of the radiant, or luminous body, from which it proceeds, the proportion of each particular colour, entering into the composition of any resulting colour, may be easily ascertained, always remembering to take into consideration the proportion of each colour in the spectrum, as shown in a preceding Number: if all the extraneous light be cut off from the eye, the effect will be increased, which may be done by placing the ground-glass in the centre, against a hole in a large screen, or a partition between two rooms, and viewing it in the dark.

If each of the apertures be furnished with a small plane reflector, the light of the sun may be employed instead of the candles, which would have a more brilliant effect, but the same facility would be afforded of varying the colours, by throwing different portions of each into the composition.

I am not prepared to say, and therefore leave for the consideration of your readers, how far this simple contrivance is capable of being applied to any useful purpose; but will venture to affirm, that should any one be disposed to try the experiment, the gratification and the pleasure it will afford, will amply compensate for his trouble, and, with your permission, I should be glad to see the result of any such experiments recorded in the pages of your very useful and interesting magazine.

I am, Gentlemen,

Your obedient servant,

A MECHANIC.

ANALYTICAL PUZZLE SOLVED.

Lincoln.

GENTLEMEN;—As none of your readers seem inclined to dispute the evidence of their senses by proving the affirmative of the assertion, that "*one is equal to two*," as proposed by your correspondent + (p. 300), I beg leave to submit the following remarks, in hopes they will prove satisfactory to the proposer, as well as to your other puzzling correspondents:—

I know of no way by which this assertion can be made out, except by something like the following:—

Let $a : b :: c : d$; then will $a\,d = b\,c$; and supposing a to decrease, or become infinitely small, d must become infinitely large; when a vanishes, or becomes $= 0$, d becomes infinite, and we have $b\,c = 0 \times$ infinity; but as $b\,c$ may be any quantity whatever, as 1, 2, &c., $0 \times$ infinity $= 1$, or 2, or any other quantity or number, and consequently $1 = 2$, &c.

To take an example of this sort of reasoning, let r be the radius of a circle, s the sine, c the cosine, and t the tangent of an arc; by similar triangles, $c : r :: s : t$; therefore $c\,t = r\,s$: now, when the arc is $= 90°$, c becomes 0, and t becomes infinite, and therefore $r\,s$, or r^2 (for s in that case $= r$) is $= 0 \times$ infinity; but r^2 may be any number or quantity whatever, as 1, 2, &c.; therefore $0 \times$ infinity $= 1$, or $0 \times$ infinity $= 2$, &c.; consequently $1 = 2$, &c.

Now, if this reasoning proves any thing intelligible on the subject, it seems to be, that there are as many different degrees or kinds of infinity, as there are finite numbers, or as there can be circles of different magnitudes; but the fact is, it proves nothing but the inability of the human mind to reason beyond the bounds of finite space; nothing is more evident than that it is always as $\frac{r\,s}{c}$, so long as it can be expressed in numbers; but when it ceases to be so, it no longer bears any proportion to the radius, or any distinct character, cognizable by the human understanding. If it be insisted, that having arrived at the conclusion that $1 = 0 \times$ infinity, and also that $2 = 0 \times$ infinity, &c. by the clearest mathematical reasoning we ought to admit the converse of the proposition as equally clear and unexceptionable; I answer, that to assume as data whereon to reason concerning matters of fact, things utterly incomprehensible to our understanding, would, to say the least of it, be ridiculous and absurd.

"We nought can reason but from what we know," and no one will contend that we can know any thing of infinity.

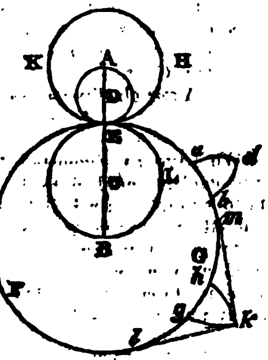
But though, strictly speaking, we know nothing of the nature of infinite quantities, or of lines infinitely extended, we know the reason why the tangent becomes infinite, where the arc is 90°; we know it is in consequence of its becoming parallel to the secant, with which, and the radius, it formed a triangle, and from the proportion of which triangle we could determine its length: these proportions now no longer exist, the triangle no longer exists, but has passed into an imaginary parallelogram, the short sides of which are the radius of the circle, and an imaginary line infinitely distant; the longer ones the infinitely extended tangent and secant. Now, this parallelogram varies with the radius of the circle, the only part which we have any just conception of as actually being the radius; that being given, of course the radius itself is given, and the supposed inconsistency vanishes into air.

A MECHANIC.

TEETH OF WHEELS.

Red Lion-street, Clerkenwell, Jan. 19, 1824.

GENTLEMEN;—The teeth of wheels is a subject of so much importance to those engaged in mechanical pursuits, that I am not a little surprised that some of your readers have not, ere this time, taken some notice of those queries which I have proposed in the 15th Number of your excellent Journal. This silence now confirms me in a belief of what I had all along supposed to be the case, namely, that working mechanics, in general, are little acquainted with any rule for forming the teeth of wheels. Should the *practical rules*, which I am now about to submit to you, be considered sufficient to fill up this blank, I hope you will, after due consideration, give them a place. For, as a certain excellent man and most acute mathematician observes, "it is to be regretted that these rules (meaning the rules of certain writers on that subject) have been little followed by practical mechanics; most of whom have, in this case, been more inclined to follow a set of hackneyed rules handed down from one workman to another, though completely destitute of scientific principles."—Now, in order to remove this imputation, I have just thought of speaking to my brethren, with your permission, through our trumpet, this *Magazine*. I believe it will be readily granted that the great beauty of every machine consists in the uniformity of its motion, and this can never be accomplished so long as the teeth of the wheels of that machine are formed with a view to please the eye rather than to produce that effect. Now, it is demonstrable, that a wheel and pinion will have the same force for moving each other, when from the point of contact of the teeth a line is drawn perpendicular to their respective curves, so as to pass through that point where their primitive circumferences touch each other; and, it is known, that the epicycloid possesses this property. It is not my intention at present to enter into any investigation as to the truth of the following construction (although I may hereafter trouble you with it), but to come directly to the practical fact. If a circle be made to roll on a circular segment, and any point be taken in the rolling circle, that point will trace a curve called an epicycloid; the rolling circle is called the generating circle of such an epicycloid. Draw the indefinite line A B, and from it cut off a portion equal to the semidiameter of the intended wheel and pinion. Suppose there are to be 40 teeth in the wheel and 8 leaves in the pinion. Let the whole line A B be



divided into 48 equal parts, and from the point B count 40, which let terminate at E; and from A count 8, which will terminate in the same point E. And since the circumferences of circles bear the same relation to each other as their respective radii, then will B E A E, be the radii of the wheel and pinion. From the centre B, with the distance B E, describe the circle E F G; and from the centre A, with the distance A E, describe the circle E H K. These circles will be respectively the primitive circumferences of the intended wheel and pinion. Bisect the radii in the points C and D, and from C and D as centres with the distances C E, D E, describe the circles E L B, E N A; these circles will be the generating circles of the epicycloidal arcs with which the teeth are to be formed. It is common to allow the space between the teeth to be the same size as the teeth themselves, but sometimes not so, according to the nature of the machinery required; but whichever way is adopted, we have only to divide the primitive circumference into as many equal parts as there are teeth intended; and these are again to be subdivided in such a manner as the strain upon the machinery may require. Let *a b* represent two points of these subdivisions upon the primitive circumference of the wheel; then take that generating circle, whose diamater is equal to the radius of the pinion, and place it upon the point *a*; let it be rolled upon the primitive circumference of the wheel in the direction *a* G, and the point of contact of the generating circle will (by fixing a pencil or projecting pin in it), in the act of rolling, trace the curve *a d*; and in like manner, by rolling it in the direction *b* E, the curve *b d* will be traced, and this completes one of the teeth projecting beyond the primitive circumference of the wheel; all the other teeth in the wheel may be formed from a wooden or metal pattern made from the original one; the leaves of the pinion are formed in a similar manner; but it must be strictly kept in view that that generating circle, whose diameter is equal to the primitive radius of the wheel, must form the leaves of the pinion; and the other generating circle, whose diameter is equal to the primitive radius of the pinion, must form the teeth of the wheel; the projecting epicycloids being formed, the teeth are then to be cut in of such a depth as to give sufficient room for the play of the engagement of the projecting teeth.

But a simpler process than this for forming the teeth of wheels may be effected by making the teeth portions of the curve called an involute, when a thread is in the act of being wrapped about a cylinder, and any point taken on the thread which remains unwound, will trace that curve. Then let *g h* be two points of division on the primitive circumference of the wheel, and let *m k* be a cord in the act of being wrapped upon a cylinder, whose base is equal to the primitive diameter of the wheel: the point *k* of the flexible line *k m* will trace the curve *k g*, and in like manner the point *k* of the flexible line *b k* will trace the curve *k h*, and the tooth is completed. Both these constructions have their peculiar advantages.

I am, Gentlemen,
Your obedient servant,
J. Y.

WESTMORELAND PEASANTRY.

Tower-street.

Gentlemen;—In your Magazine, No. 7, under the head of Domestic

Economy, is an account of the mode of living among the peasantry of Westmoreland, which is said to come from the pen of Dr. Proudfoot.

The statement is utterly devoid of truth; for there is not a more temperate, orderly, hard-working set of men in the kingdom. Their breakfast and supper consist generally of bread and milk, bread and cheese, or oatmeal porridge and milk. For dinner they have meat pies, eggs, and bacon, or dumplings. These are all the meals they have, and are all they want. They very seldom taste beer at any of their meals, and the bread they eat is coarse, brown, and leavened, and such as your south-country labourers would not touch.

Now, Sir, as a Westmoreland man, and well acquainted with the habits of the peasantry, I hope you will contradict Dr. Proudfoot's statement, and rescue an honest, sober, and virtuous class of men from the foul charge of gluttony and idleness

I am, Gentlemen,

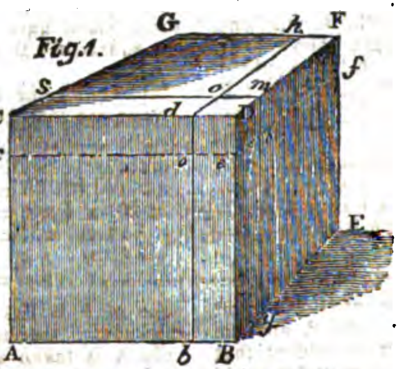
Your obedient servant

G. G.

[We have, as requested by our correspondent, applied to Mr. ——, and to several other individuals acquainted with the habits of the Westmoreland peasantry, and find that they concur with G. G. in thinking the statements of Dr. P. extremely unfounded.—EDIT.]

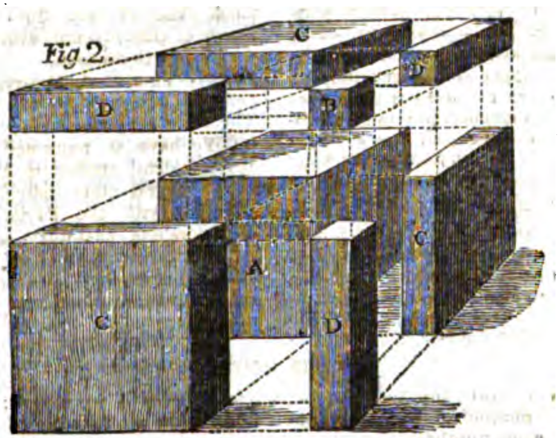
CUBE ROOT.

We now state the third or *geometrical*, perhaps we should call it *mechanical* method of explaining the composition of the cube of the sum of two lines or numbers.



Let A D F be a cube, constructed upon the line A B, of which A B C D, B D F E, and C D F G are three faces or sides: D, the solid angle at which those faces meet, and D B, D C, D F, the respective edges by which they are separated. If A B be equal to any number of parts, say 24, each of the edges will also be 24, each of the pieces the square of 24, and the cube itself will be $24^3 = 13824$. Now, let A B be divided in the point *b*, so that A *b* =20, and *b* B four, or A *b* two tens, and *b* B four units; and let the cube be cut by three planes *b d k*, *l m g*, *c e f*, parallel to the three faces, and distinct from each by the line *b* B. These planes will intersect each other in the points *o o o*, and the whole cube will be cut into eight parts, viz., from the solid angle there will be cut the cube *o* D *m*, whose side will be *b* B; from the three edges will be cut the three rectangular prisms *b e o*, *c d o*, *f m o*, having their bases the square of *b* B, and their height = A *b*; from the three from these will be cut three rectangular prisms, having their bases the square of A b, and their height = b B; and there will remain the cube of A b. A more perfect idea of these eight parts may be formed from the following figure—

Fig. 2.



In this figure the dimensions are the same as in the former one, only the pieces are shown apart from each other. A is the cube of A b, in fig. 1, B is the cube of b B, C C C, and the three prisms, whose base is the square of A b, and height b B; and D D D are the three which have three bases = the square of b B, and their heights = A b.

Reserving the former numeral values, we shall have

$$A\,b^3 = A = 20^3 \ldots\ldots\ldots\ldots\ldots = 8000$$
$$b\,B^3 = B = 4^3 \ldots\ldots\ldots\ldots\ldots = 64$$
$$3 \times A\,b^2 \times b\,B = C + C + C = 20^2 \times 4 \times 3 = 4800$$
$$3 \times A\,b \times b\,B^2 = D + D + D \ldots\ldots\ldots\ldots = 960$$
$$A\,B^3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots = 13824 = 24^3$$

Leaving out the cubes of A b and b B, that is, the cube A and the cube B, fig. 2, it is evident that the whole of the remainder could be formed into one regular prism, whose length would be three times A b, and three times b B, whose height would be a b, and whose thickness would be b B; but the cube of b B has also the same thickness; therefore, after the cube A is taken away, the whole surface or base of the remainder is $3\,A\,b^2 + 3\,A\,b \times b\,B + b\,B^2$; and calling A b, a, and b B, b, this is the same as $3\,a^2 + 3\,a\,b + b^2$, the division of the cube root, as shown by the former methods.

THE SCHEMES FOR PERPETUAL MOTION EXAMINED.

Portsmouth, March 29, 1824.

GENTLEMEN;—I shall now proceed to notice, very briefly, the communications of all those who have written in your Magazine in favour of the possibility of perpetual motion; and will show how my former remarks, contained in a series of letters addressed to you, can be made to apply to all their speculations, as well as to *machines of every description*.

"Philanthropos," in page 216, gives a sketch of a machine, which appeared to the inventor "*just the thing*." The acting power is a stream of water, and the machine consists of a series of levers, all fixed to the same axis. It is supposed that the water, by falling on the extreme ends of these levers, will give motion to the wheel, which may be made to pump up *more water* than will be expended in the operation. Now, since it is necessary that the power should be greater than the resistance in order to produce motion, then the quantity of water raised must be greater than that expended, because the moment it has been raised, *it becomes converted into the power;* and as the water cannot increase in the cistern, the ascending column, or the resistance, must be more effective than the descending column, or the power, and this is clearly impossible. Besides, I have before explained that the *theoretical effect* of a lever is no greater than the power employed, and the *practical effect* is not so great; so that the machine of Philanthropos being indebted to the lever for its principles of action, cannot move, for want of a sufficient impelling power.

I could not avoid smiling at the communication in page 252. The extreme forbearance evinced by the person alluded to in this letter, in not allowing this machine to appear before the public *until Sir Isaac Newton shall have been immortalized a full century* (which will be in 1827), is truly philosophical; and I cannot but admire the tenderness of his feelings in withholding from us so important a piece of information, from the fear of injuring the reputation of Sir Isaac Newton, by the accomplishment of an object which *he* deemed impracticable!!!

Page 281 has a drawing of a machine which also consists of levers; but we have here another device, that of altering the relative weight of the bodies employed, by rendering the active power comparatively lighter at one time than another. But we shall find here that the power expended in forcing the water apart, to make way for the increasing bulk of the bladders when filling, will be more than equal to the power exerted by them, in endeavouring to rise when filled; and as the bladders full of air, from their tendency to rise through the denser medium, form the acting power, and this acting power has to produce an effect greater than itself, in removing the pressure of the water from the bladders, *on the resisting side*, before they can be filled, such a machine cannot move; for, as in the former case of Philanthropos, the resistance would be greater than the power.

"A Friend," in page 272, believes in the possibility of perpetual motion. He states that there is a machine, made by Mr. Wansborough, at Fulham, in June 1818, which moves perpetually. It appears that the moving power is electricity; but as he does not tell us *how it acts*, he leaves nothing to argue upon.

In page 311, your correspondent F. J—k—n informs us, he can produce perpetual motion by means of a pump. The efficacy of this machine may be pretty accurately judged of from the inventor's own description of its principles. He says, the pump is to be *so* constructed, that *the same power* which will raise water *ten feet high*, will raise it to any height required, *even though it were* 10,000 *feet!!!* If J—k—n means, that the *time* to be occupied in this operation is to be increased in the same proportion as the *height*, then there is nothing uncommon in his machine, *nor is there any gain of power;* but if he means that the *same quantity of water* is to be raised 1,000 times as high, by the *same moving power*, and in *the same time*, he cannot surely be serious. I would merely refer him to that beautiful law which Nature has made to govern every mechanical operation, without an exception, viz. *that a gain of power must be accompanied by a corresponding loss of time.*

I come next to "Philo-Mechanicus," page 361. I must here refer the reader to the drawing of his machine. C is the hole through which the water issues at the top; it is intended that the water should fall upon the wheel, and give motion to it; and after having thus done its work, it is made to run off the floats of the wheel at a point just above F, which we will call P. I will now draw a line horizontally from P, until it cut another line, let fall perpendicularly from C, and this perpendicular line, which we will call C P, will express the perpendicular altitude of the descending column of water, or the *acting power*. B G is an imaginary line, denoting the surface of the water in the cistern below. Let us produce this line also, until it cut another line, let fall perpendicularly from C, and this perpendicular line, which we will call C W, will express the perpendicular altitude of the ascending column of water, or the *resisting power*. Then the column C P has to raise the column C W. But as C W is greater than C P by the distance between P and W, then C P has to raise a weight heavier than itself, which is impossible. I have here put out of the question the weight of the machine, and the friction, which would be very considerable. The invention of J—k—n will, I have no doubt, when made public, materially assist the author of this project. With regard to the power of the column of water being increased by the lever, the remarks I have before made on Philanthropos are equally applicable.

J. O. (pages 385 and 386) has fallen into a similar error with your two preceding correspondents. I confess I was a little amused with his explanation of his machine, where H is stated to be the pipe *for conveying the surplus water to the reservoir below*; of course, J. O. contemplated that the *water carried* up into the cistern by the wheel, would be *more* than the quantity employed in raising it, *thus making the effect greater than the power*. H would have very little to do, were it *merely* to carry off the surplus; but in its present situation *it would carry off the whole of the water in the cistern.*

Sinned, in pages 8 and 9 of Vol. II, mentions two methods; the reasons why the second method failed are not given. The letter states, that there is *three times* as much water to turn the screw, as is carried up by it. Now this, I confess, is to me a Hibernicism.

For, *all the water* contained in the upper cistern must have been previously carried up by the screw; and although this may be divided into three separate streams or columns, still the gross quantity of water will be precisely the same. The case then stands thus:—I have *assisting me* to turn the wheel, three columns of water, each one foot high; I have *resisting me* one column, whose perpendicular altitude is equal to the other three together, or three feet; the power and effect, therefore, being the same, an equilibrium must ensue. Some very considerable deduction should also be made for waste, as a great proportion of water would be lost by splashing (if I may so call it) from the float-boards. The machine acts on the principles of the lever and inclined plane; the power acts on the floats, which are the ends of so many levers, and the water rises up the thread of the screw, which is an inclined plane, and no power can be gained by either of these.

If I have omitted to notice the communication of any one of your correspondents, who thinks the construction of a self-acting machine possible, the omission has been unintentional.

I will now take the liberty of recommending every one who imagines he has discovered the means of constructing a self-acting machine, merely to ask himself these two questions—*What is the acting power?* and, *How is it intended to act?* Let him fairly and candidly answer these, according to the established principles of mechanics; and I think he will not lose his time in any farther attempt. To conclude—Philosophy can only be dangerous to those who choose to make her so; since, whenever she attempts to allure us from the straight paths of common-sense, and endeavours to establish principles of action which are inconsistent with the common operations of nature, we have the law in our own hands; *if we will not use it, the fault is our own;* for as the validity of every mechanical invention can only be fairly tried by a comparison with the unerring laws of Nature, we can easily avail ourselves of this most simple test, and such a comparison cannot fail to convince us of the correctness or fallacy of every new speculation. There are, indeed, some, whose amusement it is to indulge in the most visionary schemes, and who would deem it beneath them to have recourse to the laws of nature to direct them in their fanciful speculation. Such men know but little of the genuine spirit of philosophy; and as they are *determined* to go astray, it is folly to reason with them. But if nature and philosophy continue to go hand in hand, *as at present*, what may we not expect from them, when solicited with that ability which distinguishes the professors of the present day? The view which I have taken of my subject, and which it has been my endeavour to confirm (however unsuccessfully) has been, that *no such thing as perpetual motion can exist, so long as we are governed by the present system of laws; since "nothing but a total revolution of the laws of nature can remove those obstructions, which we have every reason to believe will operate to the end of time;"* and so satisfied am I with the correctness of my view of the subject, that if I have failed to make it equally clear to my readers, it has been owing to the clumsy manner in which I have pleaded, and not to the badness of the cause. Apologizing for the unexpected length to which I have been led, and thanking you for the patient hearing I have experienced at your hands,

I am, Gentlemen, yours, &c.

Henry Deacon.

LIGHT AND VISION.]

Chatham Dock-Yard, April, 1824.

GENTLEMEN;—In your Magazine of the present Vol. No. 34, I observed the expression "decomposition of solar light by the prism," or words tantamount to these: allow me to state my dissent to the adopted theory of light and vision.

I maintain that light is nothing material, and that vision does not extend to the perception of external bodies.

If light be matter, and luminous, what has become of all that luminous matter which the sun has poured on the earth for centuries, as only one-half the atmosphere is full of it at the present day, and the boreales at the poles do not evince any discharge of this accumulated matter. *Light could not* be lost, from many reflections and refractions, nor ever become dark; and yet mines are not illuminated by it. If reflected to the eye of a person standing on a shadow, that shadow should be obliterated by it. In the next place, neither the eye nor a reflected ray has any image-making power; nor could the focal spectrum of a spherical lens be other than circular, yet the *theory* admits of its being oblong or triangular. Besides, the position of the colour of the image shows that rays which are differently refrangible, have not been transmitted through the lens to form that image, as it has the most extreme colours close together, as in the image of a man with a red coat and blue waistcoat. As well might a blast of wind from the same distance indicate the shape of the orifice of the tube it proceeded from, as an *eye full of rays*, after travelling upwards of 90 millions of miles, carry the sun's image to the sense, or arrange itself on the optic nerve in the form of the reflecting planet, which form might, according to the theory, be as well triangular or oblong as circular. It may also be asked, why is not the image solid, instead of being only superficial?

Again, Newton admits that rays of light are uncoloured, and only of a colour-making nature. Colour (which is light) then, is not a property of matter, and exists only in the mind. Natural bodies of consequence are not coloured; and as no one ever saw an uncoloured body, it follows that natural bodies are not objects of sight; and that seeing consists altogether in perceiving an internal effect or mental image. And as what takes place in the mind is the consequence of sensation or organization, the cause of sensation which exists externally can be as little like the mental effect, as matter can resemble an idea; and therefore, as colour and luminousness do not belong to matter, while reflected rays are incapable of forming an image on the retina, it is conclusive that external light would be useless, and therefore has no existence in the system. Sunshine is as little material as shadow, and neither has any existence but in the mind. Let the opposers of these opinions recollect, that in all cases the thing *seen*, is but colour only, and not substance; and that as such, its situation externally is only apparently so; and then it will be granted that the illuminating of unseen, unknown, external bodies, could in no way promote vision or internal perception, any more than by reflection radiated matter could resolve itself into an image on the retina. The fact, then, is, that the prismatic spectrum is in the mind, and not on the screen; and *the sun-beam consists of two species of rays only;* one, that which constitutes the chemical base of oxygen gas; the other, the chemical base of hydrogen gas. The generic characteristics of these gases the sun-beam affords; it were irrational, then, to look for any other source. Calorific rays belong to the sun-beam as little as colorific; heat being the idea or effect of sensation, the cause of that mental effect cannot be heat. Nor does it follow that expansion of the thermometer is from heat, because that which expands a fluid, creates in the mind the idea to which the name of heat has been given.

Having thus attempted to prove that light is not matter, and that perception is confined to what takes place in the mind, I shall now, as briefly as possible, state what is my opinion as to the method by which vision is promoted.

I conceive that the rays or medium of vision are present at all times, because we see in the dark, as is the case with the telescopic tube, and when we look at water in a dark well, or at a mirror that faces a window in a long room, which may be so dark between, as that the spectator cannot see his own hand. Vision, therefore, is promoted by the pressure of the common medium, or perhaps of some highly rare medium, which constitutes part of the former, as in a vacuum the absence of air is no hindrance of vision. And as this *power* cannot be increased, while by obstructions its effects may be lessened, it would seem that the idea of blackness is the mental effect, from the excess of pressure on the optic nerve; those of colours, from degrees of pressure; and whiteness, from the minimum of pressure. A black body is the best for transmission or radiation, and may obstruct the visual medium least while the solid part of flame intercepts vision, and hence may be considered to lessen the pressure of the medium on the sense. When the eye is directed to where the prismatic red seems to be on the screen, the visual quiescent ray in contact with the sense at the time, is continuous from thence through the prism in some part, the degree of density of which lessens the natural pressure, or maximum of pressure on the sense proportionally; the sun terminating the visual ray in this instance, as flame does in any other, and the idea of blackness is changed, in consequence, to the idea of redness. After this manner all that is concerned in the perception of light or colours may be satisfactorily accounted for, without the aid of external light or luminousness.

T. H. Pasley.

WHEEL CARRIAGES.

May 18, 1824.

Gentlemen;—Wheel-carriages are of so much importance, and in such general use in this country, that even a very small improvement is of great value: this encouraged me to offer my mite in a letter to Mr. Vialls, part of which I find he sent you. As you have honoured it with a place in your useful work, permit me to explain a statement produced, I fear, by my ideas not being clearly expressed to him. He makes me say (p. 99, Vol. II) "were the line of draught equal (level) with the axletree," &c. &c. This is not my idea. The line I approve of as the best, is a straight one from the point on the collar at the horse's shoulder, from which he draws the axletree.

My pony-gig was altered on this principle, by means of a small iron rod fixed to the axletree, with a hoop at the other end to fasten the spring-hoop of the brace into, suspended by a strap. This line of draught made a considerable angle, completely embracing Emmerson's idea, and may be added to any two-wheeled carriage at little expense, and with great ease. I add for the consideration of your correspondent (p. 123), that since mechanical knowledge is more extended in Scotland, I hope the idea of adding a burthen to a load is given up. It is well known that when hills are to be ascended, the proper balance of a cart must be deranged; and the easiest method to adjust this is to lower the shafts, which can be done at pleasure to any degree required. There is a small difficulty arises, but which does not preclude its use when the hill is very steep, and the back-board is lengthened so much, that when the horse begins to draw, he in part raises the shafts again. To cure this, the practice is to shorten the belly-band. Part of the animal's force is then spent on his own chest; but still this will enable him to ascend the hill with more ease. Were carts drawn as now recommended, this inconvenience would be remedied, and the line of draught continue nearly the same.

Thus far had I written when I had the pleasure to receive No. 37, and am highly gratified to see Mr. Knox's information respecting Mr. Walker's experiment, proving as it does so fully completely my doctrine to be correct.

G. G.

RIDER'S ROTATORY STEAM-ENGINE.

Liverpool.

Gentlemen;—Having observed in the *Manchester Guardian* newspaper some severe remarks made by its editor upon Mr. Rider's Rotatory Steam-engine, with the replies made by Mr. R. there arose in my mind a strong curiosity to ascertain the real merits of this new steam-engine.

In the course of my business I was in Belfast, and embraced this opportunity of seeing Mr. Rider's engine. Upon my going to the place, a workman of his showed it to me, and also his air-pump, or furnace-blower, which is made on the same construction as his engine. The man explained both of these, by showing me the inside work of a similarly constructed water-pump, which satisfied my desire. Notwithstanding, I came away not so much gratified as if I had seen the engine at work; but having been told that at three o'clock the same afternoon it was to be working, I took care to be there at that time, and was not disappointed, but astonished, by seeing *so small* a thing producing so great an effect; and in justice to the inventor, I must say it appeared to me the most useful invention which I recollect to have seen.

Understanding that another engine of the same kind had been erected for Messrs. Grimshaw, I made it my business the next day to go to their works at the White House, which is about four miles from Belfast, and there saw the engine (a twelve-horse power) at work, and was also in a friendly way permitted to examine the work which the engine was doing. I found it going with a command of power which I should think was fully double that of a common engine of the same nominal horse power. The machines which were then driven by it were, First, two continuous calico-printing machines, one of these weighted to upwards of twenty tons upon the printing rollers, the other not weighted so heavily. Second, a plain callender, with three rollers, weighted as usual. Third, a four roller, hot glazing callender, weighted and glazing. Fourth, a double wash-mill, wrought by cranks, and washing at both sides at the same time, having three moving feet: all of these machines were going at their full speed, and doing their work very well. I also examined the fire of the engine's boiler, and the fuel then using, and found it to be very moderate.

From what I have seen of Mr. Rider's Rotatory Steam-engine, I am persuaded that it wants but few improvements to render it the most complete and useful method yet known of communicating power and motion to machinery by the agency of steam, especially where great powers are required. Nor can one reasonably doubt this, when it is considered that twenty-horse power requires only a cylinder twenty-two inches diameter, and the same in length, and that a cylinder of 88 inches diameter gives the power of 320 horses? Great as this advantage is, it is only one of the minor good properties of Mr. R.'s engine; for, by giving an immediate power and uniform motion to machinery, without any of that power being absorbed by friction, it possesses still higher claims to general preference. The description of this engine, first published in your Magazine (p. 276) is not so plain and explicit, or easy to be understood, as might be desired, and from this cause, many (although practically well acquainted with common engines) may form erroneous ideas of the real value of Mr. Rider's improvement. It is for this reason I avail myself of the medium of your liberal work, having two objects in view, one to mention my observations on Mr. Rider's engine, the other to excite Mr. R. to give a better description of his engine.

I am, Gentlemen,

Yours, with much esteem,

S. W.

AN INNOXIOUS FUEL.

(*Explanation.*)

Gentlemen;—An omission in the M. S. has misled you with regard to the tenor of a sentence in my communication, on the above subject, inserted in No. 39 of your useful and valuable miscellany. At the end of the first paragraph, immediately following the word "*enjoined*," there should have been added, "*The propriety of pointing out a system is doubtful; but as the measure was to be adopted, an additional means might have been indicated.*" It may be observed, had such been the case, the enactment would have been less liable, than it now is, to a charge of exclusiveness.

In regard to the remark on which you have commented, it was made with advertence to the *principle* of the schemes, with an inference, that the one which avoids a nuisance, is, for its simplicity, preferable to that which creates and renders necessary the destruction of an evil, and as such, claiming in consideration a priority to, but *not* the *rejection* of the other.

I am perfectly aware "there is nothing in the least impracticable in REQUIRING smoke to be consumed;" it is just as easy as SAYING to the mountain, "Be removed into the sea."—I fear we lack the requisite quantum of "*faith.*"*

Your obliged correspondent,

ANTI-FUMUS.

ELECTRICITY OF PAPER.

H. R.'s answer to No. 11 is by no means conclusive; if his test were alone to decide the question, it would disprove his reasoning. H. R. says, "If your correspondent will try the experiment of applying the paper to a sheet of glass, he will find that no adhesion will take place, because glass is itself an electric, and not a conductor of electricity." Now, if H. R. had himself tried the experiment, he never would have made this assertion, as the effect is equal to that on wood, or any other substance; nor will the effect be produced unless the paper be heated, although ever so dry. I am, therefore, yet as much at a loss how to account for this phenomenon as ever. NEB DIRPE.

WATCH-MAKING.

Wellingborough.

GENTLEMEN;—I send you for insertion a specification of a train of wheels, which I am persuaded is not generally known, and which may be beneficial to some ingenious clockmaker, who is called upon, or wishes to make a time-piece, that shall not only show the seconds, minutes, and hours of the day, but also the day of the month, the exact degree the sun occupies in every sign of the zodiac through the year, with many other things he may think fit to have engraven on the dial. Let a wheel of twenty-four teeth, or a pinion of twelve, fixed upon the arbor that goes round by the common movement in twelve hours, turn a wheel of sixty, or thirty, having a pinion of six on its arbor, turning another of sixty-seven, and its pinion of six will turn a wheel of one hundred and fifty-seven in 365 days, five hours, and fifty minutes. This is perhaps the nearest calculation which can be found for tooth and pinion, for a hand to be carried round the dial in a solar year.

Your humble servant,

A. B. C.

Note.—If the first is a pinion of twelve, the second must be thirty, or they may be both halved again without affecting the motion.

* We must, in turn, have one word of explanation. Our correspondent is witty upon a mere inaccuracy of language. We should have expressed ourselves thus—"Nothing in the least impracticable was required, when it was enacted that smoke should be consumed." Nor is this a matter of *faith*, but *practice*.—EDIT.

LITHOGRAPHIC PAPER.

May 20, 1821.

GENTLEMEN;—The Lithographic Printing Paper from the manufactory referred to in your last Number (p. 15) is, I believe, the best for the purpose that can be obtained in *London*; but it has still a fault, which precludes the possibility of using it to any extent, viz. *the soap in its composition*, which, by its repeated application to the stone in printing, destroys its preparation, and by forming a coat of grease on its surface, renders it impossible to produce clean impressions.

Grease, and the several salts used in the manufactory of paper, are the only obstacles to the successful cultivation of lithography in this country, which are not under the control of those who practise the art, the whole of the materials, with the exception of the paper, being prepared by the lithographer himself.

After the execution of the lithographic subject on the stone, with chemical or saponaceous ink, and its subsequent preparation with acid, the chief care of the lithographer is, to prevent a further application of these substances in any form to the uncovered parts of the stone, the first of which would inevitably soil the impressions, and the second destroy the fine parts of the subject, by dissolving and carrying off those portions of the stone which are unprotected, or not sufficiently protected, by the chemical ink.

I trust that in a short time the

subject will be taken up by some person connected with the manufactory of paper, with the view of effecting the desired improvement in its composition, and thus contributing his endeavours for the furtherance of an art, which our continental neighbours have proved, beyond dispute, to be worthy of the pains bestowed upon it.

By the insertion of the above remarks in your very useful miscellany you will much oblige

Your constant reader,

LITHO.

AN UNALTERABLE WHITE FOR WATER PAINTING.

Dissolve four ounces of Roman alum in as small a quantity of hot water as is barely sufficient, and then mix it with two ounces, or two ounces and a half of honey. Set this mixture to evaporate to dryness in an earthen vessel, over a gentle fire. It will then appear like a spongy sort of coal, which being removed from the fire, must be pounded, and the powder placed in shallow crucibles or cuppels, so that it may lie very thinly on them. Expose these to a strong *red heat* for an hour. After this the powder must be pounded again, and being replaced in the cuppels, it must be exposed anew to a strong red heat, and to a free current of air for an hour longer. Being then removed from the fire, it is reduced upon a porphyry to an exceedingly fine powder of an intense whiteness. It may be mixed with gum water, in the same manner as other paints are usually treated; and is not apt, like white-lead, to turn to a dusty hue. WM. GATWARD.

Reading.

INQUIRIES.

No. 17.—TUNNELS AND BRIDGES.

As a tunnel of brick is going to be erected under the Thames, the following questions, I think, of great importance at the present moment:—

1. What was the cause of Highgat tunnel falling in?

2. What is the best form of an arch for a tunnel, constructed of brick or stone?

3. What is the best form for one constructed of cast-iron?

4. The best mode of ascertaining, by experiment on a small scale, the best forms of arches?

"As the arches of modern bridges differ very much from each other, it would seem that architects are not agreed as to the best form, whether it should be semi-circular, eliptical, catanarian, &c. I need scarcely observe, that there is a great difference between a bridge and a tunnel as regards the arch. The bridge has only to support its own weight and that of the carriages, but the tunnel will have to support both the earth and water above it. One cubit foot of fresh water weighs 62½ lbs.; at high water there will be above 20 feet; besides which, there will be 30 feet of clay. The proposed tunnel, too, is to be 35 feet wide. Can bricks, if made of the common or general form and texture, support so great a pressure? J. JOHNSON.

NEW PATENTS.

To Jean Henry Petelpierre, of Chalton-street, Somer's-town, in the parish of St. Pancras, in the county of Middlesex, engineer; for an engine or machine for making the following articles from one piece of leather, without any seam or sewing whatever; that is to say, all kinds of shoes and slippers, gloves, caps, and hats, cartouche-boxes, scabbards and sheaths for swords, bayonets, and knives.—Dated March 20, 1824—two months.

To John Heathcoat, of Tiverton, lace manufacturer; for improvements in certain parts of the machinery used in spinning cotton wool or silk.—Dated March 20, 1824—six months.

TO CORRESPONDENTS.

The notice to P. A. S. was meant for G. A. S. We shall be most glad to hear from him.

G. B. would oblige us by *stating* his "reason for believing."

G. B. Secundus is intended for insertion.

Communications received from "A Lover of Useful Inquiry"—H. D.—J. Austin—H. S.—P. C.—James Marsh—T. B. M.—Chrunismus—C. S.—Minimus—H. B.—No Philosopher—E. S.—Omikron—T. P.—G. C.

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Happy in Error's sea who finds the land,
Or o'er Delusion's waves his limbs can buoy;
We use the Arts we cannot understand—
And what we know, we know not to employ.
Goethe's Faust, translated by Lord F. L. Gower.

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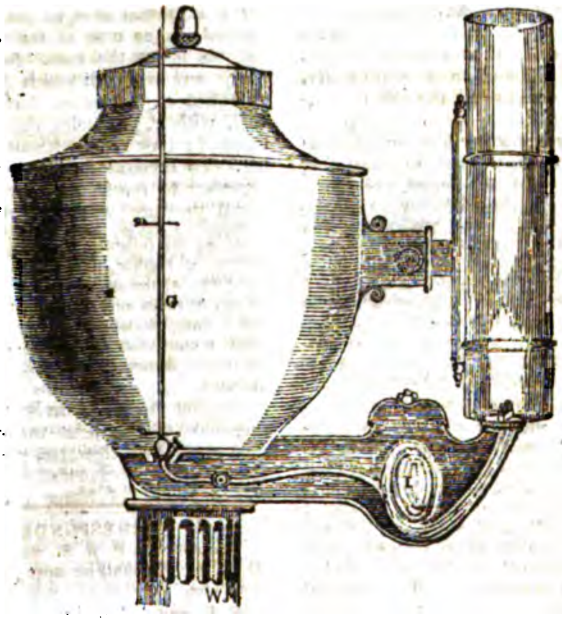


DESCRIPTION OF A NEW SELF-REGULATING LAMP.

The principle of this lamp is that of the ball-cock. The manner in which it operates will be immediately understood from a slight consideration of the prefixed figure of it, in which the several parts are represented in the situations which they respectively assume when the reservoir is empty. Those parts only are noticed which are necessary to explain the manner in which the lamp regulates itself.

A is a valve at the bottom of the reservoir, to which is attached an upright stem G, moveable vertically through holes in the projecting pieces of metal *m m*.

B is an air-tight vessel of a globular form, and so light as to float in oil (a piece of varnished cork might be substituted).

D is a bent wire, moveable about C as a centre, having one of its ends soldered to the vessel B, and the other in contact with the valve A.

E is the burner, with its socket, wick, &c.

F is a lid which covers the chamber, inclosing the vessel B, and which may be removed when necessary for the purpose of cleaning, &c.

While the parts of the lamp are in the situation just described, let oil be poured into the reservoir. It is manifest that it will flow through the aperture at the bottom into the chamber containing the hollow vessel B, which will in consequence float, and be caused to ascend. Hence the opposite extremity of the bent wire D will descend, and the valve A will follow it by its own gravity, closing the aperture, and preventing the further efflux of oil. As, however, the oil is gradually consumed in the burner, it is manifest that B will descend, and consequently elevate the opposite extremity of the wire, together with the valve A, thus causing a fresh efflux of oil, and so on continually, until the whole of the oil is consumed.

It may be further observed, that in addition to the property of consuming all the oil just mentioned, this lamp keeps the surface of the oil in the burner always very nearly at the same distance from the flame; moreover, that it projects no shadow from itself, and may be supplied with oil while burning, &c. &c.

W. M.

MR. PERKINS' STEAM-ENGINE.

(Further Particulars.)

"The difficulty of getting my generator," says Mr. P. in the pamphlet which we mentioned in our last, "made tight enough, has occasioned great delay, which very much alarmed my friends, and gave an opportunity for my opponents to say, that the visionary scheme, as they prognosticated, had entirely failed; but as I never once doubted that I should succeed in getting my generators made to my mind, I felt quite at ease on that score. I however extremely regretted the delay which this practical difficulty occasioned, especially as the public mind was highly excited, in consequence of the great expectations raised by the novelty and promise of the theory. I have at last the pleasure of having my anticipations and wishes perfectly gratified. After consulting with Mr. James Russel, of Wednesbury, in Staffordshire, on the best method of executing this piece of work, he, at a considerable expense, has succeeded in delivering me the best piece of workmanship in wrought-iron that was perhaps ever produced. This part of the generator (which is denominated the receiver) has sustained a pressure of 1,400 atmospheres, or 19,600 lbs. on the square inch; it is cylindrical, eight inches external, and five inches internal diameter, with each end drawn in hemispherically; it is made of scrap iron, and without joint or rivet."

It has been supposed that the danger of explosion must be greatly increased in the case of this engine; but this is not the case. Several of the generators with which Mr. Perkins has experimented have given way, without producing the slightest mischief; they rend without exploding. To account for this it is only necessary to remember that the internal pressure was that of *water* and not of *steam*, and that when the fracture opened, the water rushed out much faster than it could be supplied with heat, by which means the fire became extinguished. The disastrous effects heretofore occasioned by the explosion of steam-boilers are, in fact, by Mr. Perkins' mode of generating steam, entirely removed. Instead of that immense magazine of steam and heated water, the explosion of which has been often so fatal, only one pint of water per horse-power is used, while from fifty to seventy gallons are necessary for the common condensing engines.

The reduction effected in the quantity of water employed is equal to about ninety per cent; and the danger to be apprehended is diminished in a still greater proportion; for as the capacity of the steam vessel is reduced, the means of increasing its strength are increased.

Another very curious fact developed by Mr. P.'s experiments is, that when the temperature of the metal of the generator is raised much above that of the water, it repels the water from it, although under a great pressure, and a stratum of steam becomes interposed between the water and the bottom of the boiler. In proof of this, Mr. P. mentions that, though a fracture had in one instance occurred in the generator sufficiently large to have let off all the water, yet by keeping up a sharp fire, the engine was enabled to work all day without the steam or water escaping. When the temperature, however, of the metal was lowered, the water flowed out, and it was found useless to attempt to check it. The experiment was repeated several times, and always with the same effect. Mr. P. conceives that this experiment sufficiently accounts for the circumstance that the bottoms of steam-boilers and stills so frequently burn and crack: instead of ascribing it, as is commonly done, to the non-conducting property of the sediment deposited, he attributes it to the non-conducting power of the stratum of steam between the water and the bottom of the boiler.

Mr. P. has further ascertained that high steam has the property of preventing any deposit or incrustation from taking place. The quality of the water employed is thus rendered unimportant, and all the pipes and other vessels kept, without trouble, perfectly clean.

STEAM ARTILLERY.

Mr. Perkins having observed, while experimenting with the generator of his new steam-engine, that substances, whether metallic or otherwise, when they rose from the bottom of the generator through the tube of the stop-cock, were projected with great velocity, the thought struck him that with a properly constructed gun, projectiles might be thrown with great power and economy. It also appeared to Mr. P. that it would at once settle the important question respecting the velocity as well as power of high elastic steam. No time, therefore, was lost in constructing a gun, and at the first experiment Mr. P.'s most sanguine hopes were realised, as musket-balls, at the rate of 240 per minute, were projected with a velocity equal to the utmost effect of gunpowder. The consequences of this discovery Mr. P. is almost afraid to contemplate; for such he conceives to be the power, economy, and simplicity of this new agent, that *one projectile* will be found sufficient *to force any breach*, or *sink the largest ship*. It will in fact be to gunpowder what that was to the arrow.

Mr. P. has found that a pressure of forty atmospheres is equal to gunpowder. Thus, an ounce ball discharged against an iron target, from a barrel six feet long, and about a thirty-second part less in the bore than the ball, was flattened to two inches and a half in diameter; and when projected with a force of forty five atmospheres, the blow against the target liquidated the lead. An ounce ball discharged from a musket with powder, with the common field charge, at the same distance, did not show more effect.

It has been said, there must be some fallacy in this experiment, since as it takes a pressure of from 800 to 1,000 atmospheres to propel a ball with proper effect with powder, it is not to be credited that it can only take 40 or 50 atmospheres of steam to do the same.

Mr. Perkins replies by an appeal to *the fact* that such is actually the case; and suggests that the cause may be the same as that which accounts for the circumstance, that fulminating powder, although infinitely stronger than gunpowder, will not (though it bursts the gun) throw a ball one-twentieth part as far—namely, that the power is too instantaneous for projectiles, and that gunpowder being less so, gives greater effect, although the mechanical pressure is much less. "Steam power," says Mr. P. "acting with constant pressure on the ball until it leaves the gun, in consequence of the non-diminishing generation of it, is, I believe, the cause of the increased effect."

Mr. Perkins has taken out a patent for this new branch of his discoveries.

IRON SHIPS.

Since the discovery by Mr. Perkins of so vast a destructive power as his steam artillery, it becomes of more importance than ever that nations should learn to make their ships as shot and shell-proof as possible. On this subject there is, in Ferusac's *Bulletin des Sciences Technologiques*, a memorial by M. de Montgery, a captain in the French navy, which is well worth attention, and from which chiefly we shall extract the materials of the present notice.

The author's object is to recommend the universal adoption of iron instead of wood in the structure of ships. A multiplicity of objects formerly composed of wood, are now formed of iron—bridges, arches, aqueducts, public highways, and other objects not so collossal, but very important in their application to maritime affairs, such as wrought-iron tanks, and hollow cylinders for masts and yards, and chains in lieu of hempen cables and cordage. But why up to this time have there been so few vessels constructed entirely of iron? Will not mankind at some future period wonder how enlightened nations could have thought of building objects so stupendous and so expensive with so fragile and perishable a substance as wood, whilst they possessed a material to substitute for it so solid and durable as iron? The ordinary term of duration of wooden ships is twenty years; and during that period they must be hove down and thoroughly repaired three or four times. To the duration of an iron ship, on the contrary, it would be difficult to assign any period. Vessels of this description have no need of caulking, or copper bottoming. Little subject to leaks, there is the less fear of their running ashore; and still less are they subject to the casualty of fire. The first cost of them might be greater (that we doubt); but from their far greater durability, and standing so little in need of repairs, the saving in the end would be immense. It deserves farther to be considered, that large timber is becoming every day more and more scarce, while from the increased dimensions of new ships, more wood is required in ship-building; of iron, on the contrary, the stores are inexhaustible. It may be said, that the adoption of iron would serve to uncraft or disqualify a numerous body of men (the shipwrights), and throw them for a time out of employment. A temporary inconvenience to a few ought not, however, to be opposed to a great general good, considering, moreover, how much the country at large would gain by the increased activity which this new demand for iron would give to our mines, commerce, and agriculture.

M. Montgery contends, that while we have vessels of war constructed of wood, they should at least be plated with iron; and it will be seen from the following passage, that he had distinctly anticipated such an application of projectile force as that discovered by Mr. Perkins:—

"For more than three hundred and fifty years it has been in agitation to throw shells from mortars *horizontally* instead of elevating them according to the general practice. The adoption of howitzers in the field of battle, independently of a great number of special experiments, has at length proved, beyond doubt, the importance of this mode of firing, which it has also been proposed to adopt on board of ships, and on marine batteries."

Long before any one had thought of substituting metal for wood in the construction of large vessels, plates of iron or brass had been used for covering ships of war and battering-rams. The celebrated galley built by Archytas and Archimedes, for Hiero, tyrant of Syracuse, was cased in this way. Philo of Byzantium afterwards proposed using battering machines made entirely of metal; but Father Mersenne appears to have been the first who thought of adopting them for ships.

M. Montgery says, that to render the sides of a vessel shot and shell-proof, they should have a plating of iron about six inches thick; that is, a series of sheets of iron, with blocks of cast-iron between. He conceives that the block would only be necessary in the parts exposed to the fire of the enemy, and that there would be no occasion for them towards the keel of the vessel.

ANALYSIS OF CONTEMPORARY SCIENTIFIC JOURNALS.

Philosophical Magazine *for March, April, and May,* 1824.

This Journal increases in reputation among men of science, and ranks some of the ablest of them among its contributors; but there is a profusion in its pages of matters either of pure speculation, or of dry nomenclatural detail, which allows us to glean but little from it in aid of the humbler task we have undertaken, of diffusing a knowledge of facts which all can understand, and all turn to some practical account.

One of the most interesting (to us) of the articles in the Number before us, is a biographical account, by a Lieutenant Zahrtmann, of the mathematical and astronomical instrument makers at Paris. The most distinguished are—for chronometers, the family of Breguet; for mechanical and mathematical instruments, MM. Fortin, Gambey, Lenoir, Richer, and Jecker; and for optical instruments, MM. Lerebours and Cauchoix.—Of M. Fortin we are told—

"He is seventy-two years old; a provincial by birth, and came when quite young to Paris, where he commenced business in some of the most humble workshops. He has always worked very assiduously, but has been unable to raise a fortune by his labours. M. Fortin first attracted notice by the perfection with which he executed balances and pneumatic machines: he still works, and with much accuracy, notwithstanding his advanced age; and in the construction of measures, barometers, and pneumatic machines, he has scarcely ever been surpassed. The most remarkable instrument which has left his workshop is the great meridian circle erected at the Observatory, to which it was presented by the Duke d'Angoulême. This instrument is in imitation of the Greenwich circle, but the divisions are executed in a different manner, peculiar to M. Fortin; the fastening of the radii at the centre is more firm in his instrument, and the divided limb is formed of an alloy of gold and palladium, a sixth part consisting of the latter metal; this combination, without becoming oxidated like silver, and without being too hard for the dividing point, as platinum is, produces a metal upon which the divisions are very easily discerned. M. Fortin possesses a dividing instrument which he has been for forty years endeavouring to perfect, and of which he makes a profound secret; but notwithstanding all his care, his repeating circles are far from being correct with regard to division. He is a member of the Legion of Honour, and received a gold medal at the exhibition of 1819."

Gambey, who ranks next to Fortin, is a young man, only thirty-six; but has already acquired a very high reputation. An equatorial which he made for the Observatory, is said to be the best of the kind ever executed in France. It is moved by a pendulum.

"The circle is three feet in diameter, and is divided upon its edge in equal divisions of 5′; the reading is effected by two microscopes, furnished with micrometers, and placed upon projecting arms from the centre of the axis. The telescope is by Lerebours; its length is five feet, and the diameter of the aperture is 45 lines. The axis, which is seven feet in length, appears to be less conical than in the instruments of Reichenbach; but it is balanced by a counterpoise, by which it is supported at the end upon two wheels; the instrument is in general perfectly balanced in all its parts: the movement by the pendulum, which is communicated by a screw, is sustained uninterruptedly during a period of time rather longer than an hour; the level, or, more properly speaking, levels (for there are two) are constructed in a particular manner, so as to suffer the axis to be levelled independently of its form, being more or less perfectly cylindrical."

Gambey employs a dividing instrument which possesses the advantage of not requiring the *centering* of the instrument that is divided; but the process by which this is done he has hitherto kept quite secret.

The manufacture of optical instruments in Paris is, according to lieutenant Z.'s account, in a very low state.—A M. Thiele, who went to Paris after having worked a year with M. Frauenhoffer was quite astonished at the mechanical poverty which he observed in all the optical manufactories of Paris, and remarked to Lieutenant Z., that at Benedictbeurn no one would take the trouble to work glass with the hands in the way in which it is done at Paris.

M. Pecqueur, the superintendant at the *Conservatoire des Arts et Métiers*, showed Lieutenant Z. a clock which exhibits with great accuracy sidereal time, and mean solar time.

"He has contrived this by means of a mechanical invention, which enables him to give the same force to two different movements of the clock: for instance, to two wheels, whose movements are to each other in any given ratio. The pendulum of this clock is compensated by mercury contained in the annular space formed by two concentric cylinders, the inner one of which is made of iron, and the outer one of glass; and, as the expansion of iron by heat exceeds that of glass, this serves to augment the compensation already produced by the expansion of the mercury. The cylinder of iron is hollow, and open at both ends; and consequently enables the air as much as possible to affect the temperature of the mercury. The rod of the pendulum is made of steel. M. Pecqueur showed me also a similar contrivance for pocket chronometers. The movements of the watch being attached to this piece of mechanism, the watch will infallibly adapt itself to the motion required. This effect is produced by a spring, which acts upon the spiral."

Another paper of very considerable interest, by Mr. Francis Baily, F. R. S. gives an account of *Mr. Babbage's new Machine for Calculating and Printing Mathematical and Astronomical Tables.* This invention he characterizes, with truth, as one of the most curious and important in modern times; whether we regard the ingenuity and skill displayed in the arrangement of the parts, or the great utility and importance of the results. Its probable effect on those particular branches of science which it is most adapted to promote, can only be compared with those rapid improvements in the arts which have followed the introduction of the steam-engine.

"The object which Mr. Babbage has in view, is the formation and printing of mathematical tables of all kinds, free from error in each individual copy: and from what I have seen of the mechanism of the instrument, I have not the least doubt his efforts will be crowned with success. It is extremely simple in its construction,* and performs all its operations with the assistance of a very trifling mechanical power. Its plan may be divided into two parts, the mechanical, and the mathematical.

"The mechanical part has already been attained by the actual construction of a machine of this kind: a machine for computing numbers with two orders of differences only; but which I have seen perform all that it was intended to do, not only with perfect accuracy, but also with much greater expedition than I could myself perform the same operations with the pen. From the simplicity of the mechanism employed, the same principles may be applied in forming a much larger machine for computing tables, depending on any order of differences, without any probability of failure, from the multitude of wheels employed. The liberality of our government (always disposed to encourage works of true science and real merit) has induced and enabled Mr. Babbage to construct a machine of this kind, capable of computing numbers with four orders of differences, and which will shortly be completed. To this machine will be attached an apparatus, that shall receive, on a soft substance, the impression of the figures computed by the machine, which may be afterwards stereotyped, or subjected to some other process, in order to insure their permanency. By this means each individual impression will be permanent.

"The mathematical part depends on the *method of differences* to which I have above alluded—a principle well known to be at once simple and correct in its nature, and of very extensive use in the formation of tables, from the almost unlimited variety of its applications. It has been already successfully applied in the computation of the large tables of logarithms in France; and is equally applicable in the construction, not only of astronomical tables of every kind, but likewise of most of the mathematical tables now in use.

"But the full and complete application of this, and indeed of every other principle in the formation of tables, has been hitherto very much impeded

* A full description of it we are promised for insertion in an early Number.

by the impossibility of confining the attention of the computers to the dull and tedious repetition of many thousand consecutive additions and subtractions, or other adequate numerical operations. The substitution, however, of the unvarying action of machinery for this laborious, yet *uncertain* operation of the mind, confers an extent of practical power and utility on the method of differences unrivalled by any thing which it has hitherto produced, and which will in various ways tend to the promotion of science."

The importance of Mr. Babbage's machine, as substituting an *infallible* means of computation, for the *uncertain* operation of the mind, is strikingly exemplified by one fact, of which Mr. B. takes notice. Dr. Hutton was employed by the Board of Longitude to form a multiplication table of all numbers, from one to 1,000, multiplied by all numbers less than 100. These were printed by their directions; and it is to be presumed, that no expense was spared to render them accurate; yet in one page only of these tables (p. 20) no less than forty errors occur, not one of which is noticed in the printed list of errata!

Dr. Hare of Philadelphia has furnished one or two valuable papers, chiefly on electro-magnetism and galvanism. We extract from them the following simple experiments:—

Combustion of Iron by a Jet of Sulphur in vapour.—If a gun-barrel be heated red-hot at the butt-end, and a piece of sulphur be thrown into it; on closing the mouth with a cork, or blowing into it, a jet of ignited sulphurous vapour will proceed from the touch-hole. Exposed to this, a bunch of iron wire will burn, as if ignited in oxygen gas, and will fall down in the form of fused globules, in the state of protosulphuret hydrate of potash, exposed to the jet, fuses into a sulphuret of a fine red colour.

Easy mode of imitating Chalybeate Waters.

Dr. Hare, of Philadelphia, has remarked, that if a few pieces of silver coin be alternated with pieces of sheet iron, on placing the pile in water, it soon acquires a yellowish hue and chalybeate taste, and in twenty-four hours flocks of oxide of iron appear. Hence, by replenishing with water, a vessel in which such a pile is placed, after each draught, we may have a sufficient substitute for a chalybeate spring. Clean copper plates alternating with iron, would answer, or a clean copper-wire entwined on an iron rod; but as the copper when oxidated yields an oxide, it is safer to employ silver.

We mentioned in our first notice of this Magazine, that the proceedings of the different learned societies are "more fully detailed in it than in any other journal;" nor do we see any reason to retract this meed of praise. But how is it that month after month we look in vain in its pages for any notice of the Mechanics' Institutions established in the metropolis and other parts of the kingdom? Why are they so designedly, as it were, overlooked? Why is their establishment not even noticed? It does seem as if there were *some* truth in what appeared at first to be a very foolish imputation cast on *the philosophers*, in the London Journal of Arts and Sciences, namely, that they look with coldness on the attempts that are now making to diffuse a knowledge of science among the working classes. And yet one of their number—one of the respectable Editors too of this very Magazine, condescends to be an active and zealous member of the Committee of Managers of the London Mechanic's Institution! Is he ashamed of his own work?

LAWS AGAINST COMBINATION,

AND

EMIGRATION OF ARTIZANS.

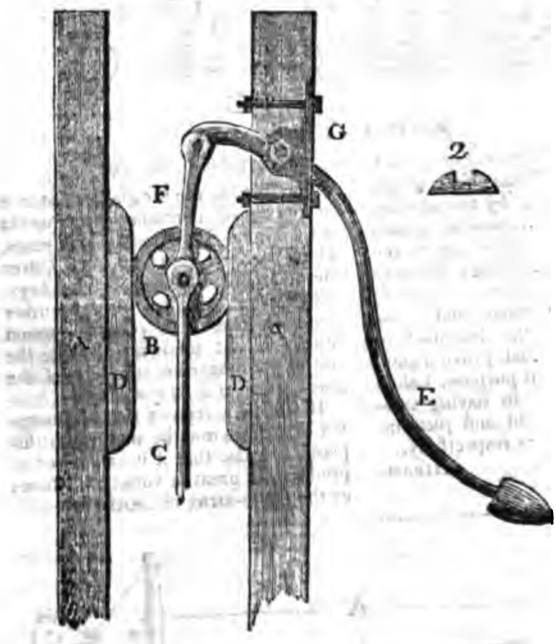
The Committee of the House of Commons appointed to examine evidence on these laws, have reported it as their opinion, 1. That masters and workmen should be freed from the restrictions under which they are placed, by the existing laws against combinations, and that they should be at liberty to make such agreements as they think proper; but that it is expedient, in order to ensure the better execution of all contracts between them, that the Arbitration Laws should be consolidated and amended. 2. That the laws against the Emigration of Artizans should be wholly repealed.

Mr. HUME, the indefatigable promoter of these laudable measures, has accordingly brought into the House three bills, which are now in progress; one to repeal the Combination Laws, a second to repeal those prohibiting Emigration, and a third to consolidate and amend the Arbitration Laws.

We may mention, as evidently arising out of the evidence given before the Committee, that Sir CHARLES STUART, our ambassador in France, has published notice to this effect:—"That all British workmen employed in France, and desiring to return to England, will, upon application to his Britannic Majesty's Embassy, receive *every facility to return.*"

Exportation of Machinery.

The Committee have, on this branch of their inquiry, recommended that it should undergo a farther investigation in the next session of parliament.



IMPROVEMENT IN PUMP IRONS.

Lincoln, April 10, 1824.

GENTLEMEN;—The above is a representation of an improvement in the construction of pump irons, which was invented by me about twelve months ago, and was so much approved as to be immediately adopted by the other plumbers in this city and its neighbourhood; and as it may be beneficial to others, I trust you will oblige me by allowing it a place in your widely circulated and very interesting Magazine.

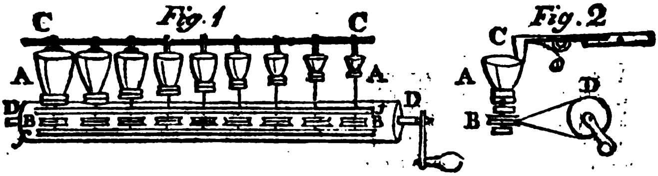
Description.

A A represents the front edges of the pump sides or standards; B, a cast-iron friction wheel, 5½ inches diameter, for the purpose of keeping the bucket-rod C in a perpendicular direction; it works in two grooves, made for that purpose, in two pieces of hard wood D D, which are fastened to the sides of the standards (fig. 2 represents a section of these pieces); E the handle, which may either be of wood or iron; F connects the handle to the centre of the wheel by two steel bolts; G, a cast-iron chair, in which is fastened a brass bush; two of these chairs are let into the side of the working standard, one on each side of the handle, and made fast by screw-bolts and nuts. The handle has a fast axle, which works in the brass bushes, and which should be turned and made to fit very exact, as should also the steel bolts. The motion will then be very steady, and the pump will last for years without getting out of repair.

I remain, Gentlemen,

Yours, respectfully,

J. Bennett.



MUSICAL GLASSES.

London, Feb. 15, 1824.

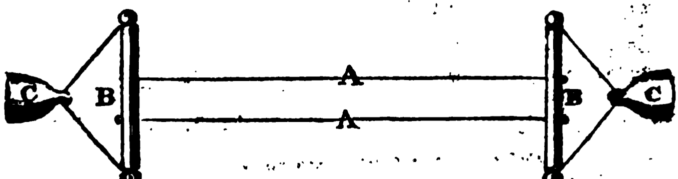
Gentlemen;—I have for a length of time thought that by the addition of a little machinery, musical glasses might be converted into one of the most harmonious and delightful pieces of music of which the imagination can form any conception; and if the arrangement of them described in the above drawing shall prove a good plan for effecting that purpose, I shall feel extremely happy in having contributed to the delight and pleasure of mankind. Yours respectfully,

Hiram.

Description of the Drawings.

Fig. 1, A A, are the glasses fastened on the top of a spindle, which works in the frame *f f*, by means of strings, which proceed, from the roller *d d*, over the pulleys B B; C C are the keys, with a piece of Indian rubber, or other material that will produce sound similar to that made by rubbing the end of the finger on the edge of the glass. Fig. 2 is an end view.

It will be perceived that any number of glasses may be worked on this plan, and also that it is calculated to produce as great a variety of tunes as the piano-forte, or nearly so.



APPARATUS FOR LETTERING THE BACKS OF BOOKS.

Description of the Plate.

A A are two pieces of black silk, with knots at each end, which pass through two split pieces of wood at B B. The strings are to be set to the size of the letters to be used, then laid across the back of the book, where they will be kept stationary by the weights C C. The letters may then be worked off between the strings, which will assist the workman to keep the letters straight.

I do not see why words of such common use as LEDGER, JOURNAL

&c. might not be cut in one piece of brass, and worked off by means of a small press, and I most earnestly request the attention of some scientific person to this part of bookbinding, which I consider at present as being very imperfect.

Should you, gentlemen, consider the above fit for publication in your valuable Magazine, you will confer an honour on your obliged

Humble servant,

W B. Jun.

PREVENTION OF DRY-ROT.

MR. LUKIN'S EXPERIMENTS.

GENTLEMEN;—In continuation of my former letter on the "Felling and Seasoning Oak Timber," I shall in this endeavour to point out the fallacy of all external applications to timber as preventive of the dry-rot.

As it is a well-known fact, that previous to the custom of felling oak timber in the spring of the year, little was ever heard of the dry-rot, I think it will not be assuming too much, if we infer that this pernicious custom is the primary cause of the decay of our ships, &c.; and as most writers on this subject agree that a superabundance of aqueous particles are the active agents in this work of destruction, it does not appear to me, that an external application (of whatever nature it may be) is of any use, for these two reasons—1st. Any preparation, however subtile its nature, will not penetrate into the wood more than half or three quarters of an inch; 2nd. The above-mentioned aqueous particles, or whatever may predispose the timber to the dry-rot, pervade it all through. But as the result of experiments in these matters is better than supposition, I shall beg leave to relate what occurred a few years ago in Woolwich dock, which will strongly confirm what I have advanced.

I went to Woolwich to see a friend (a very clever mechanic belonging to the dock-yard), who in the course of conversation mentioned a plan which was then in hand for seasoning oak timber in an exceeding short space of time, and likewise for preventing the dry-rot. As we were both in the line, he took me into the Dock-yard to see this process, and the magnitude of the means employed did not a little astonish me. A large building was erected (the walls of which were of an amazing thickness), and divided into three stories; the entrance to each was by a cast-iron door of great strength, and the whole was payed over on the outside with a composition of mineral paint, fish-oil, &c. and on the inside with Roman cement, so as to render it completely air-tight. I believe it had two furnaces (if not more), which were projected in the body of the building, so that the temperature could be raised to any given height. The timber to be seasoned was put into the building, and first having been lighted in the furnaces, it was subjected to a great degree of heat, and the vapour arising from it, made its escape by flues round the building, which communicated with a chimney. On the top of this chimney was a lid, which, when let down, and the furnaces closed up hermetically, shut the building. This was necessary for the second part of the process, the prevention of the dry-rot. After the timber was sufficiently dried, a gas (of course known only to the projector, a Mr. Lukin) was to be introduced into the pores of it, and this was to be effected by means of a gasometer attached to the building; but, whether any pressure was to be applied, so as to force the gas into the wood, I cannot tell, though I verily believe it was left to find its way in as well as it could, nothing more being done from what I could see than opening the communication between the gasometer and the building.

In the first experiment that was made, the temperature of the building was so high, that the whole of the timber, thick stuff, &c. came out charred, and not fit for any purpose. In the second experiment, the timber (part of which I saw taken out myself) had not derived the least benefit from the seasoning; for when it was pronounced fit for use, on probing it half an inch, it was as green as when it went into the building. This was particularly observed in the beams of the Nelson (either the orlop or gun-deck), which ship was then building. As to the penetration of the gas, I could not discover, except by an unusual smell and taste, just on the surface of the wood, that any thing had been done to it. I am certain it had not penetrated the thickness of a shaving. The third and last experiment was most disastrous in its consequences; for during the seasoning of the timber, the lid of the chimney was fastened down, and the air in the building became rarefied to such a degree that it blew up the building, and killed five or six people, besides wounding a great many. This put an end to Mr. Lukin's plan for seasoning timber. This experiment was on a large scale, and without any regard to the expenses that might arise; and every attention was paid by the parties concerned to obtain satisfactory results. I think it may be safely inferred, that artificial methods of seasoning will not answer; for unless a degree of heat is employed which will destroy the texture of the wood, it will never get rid of the moisture it contains; and if any coating is put on the timber as a preventive of the dry-rot, the more impervious it is the worse it is; for it confines the enemy instead of letting it make its escape. It is well known to shipwrights and carpenters that timber that has been painted or payed over with any unctuous substance, will present a fair appearance to the eye; but when a tool has been used to it, the heart has been found in a state completely pulverent. I think that this form of the dry-rot is decisive evidence, that the decomposition begins from within, and not from any absorption of matter from the atmosphere, as in that case the surface of the timber would be first affected.

Another appearance which I likewise think is indicative of *internal* decay is the appearance of fungi on the outside, and my reasons for this are founded on some observations I made about five years ago on a piece of oak timber, which formed part of the paling of my garden (one of the posts); when put down, the timber had not been cut from the main piece above five or six days; and after it had been in its situation a couple of months, it began to throw out fungi at the top or end grain; it was about six inches square. I took it up, and cut it down the middle, and on examining it with a powerful magnifier, discovered that the pores of the wood were filled with a filament similar to mushroom spawn. I took some pieces of the wood, and placed them in a moist situation (but under cover), and in a few days after fungi had formed on them similar to what appeared on the piece when in the garden. This experiment I repeated with several pieces of the same wood at different intervals, and always with the same result. I have since met with oak timber, the pores of which seemed filled with a white substance, which, when examined with a powerful magnifier, appeared similar to what I have now mentioned, and I have no doubt that when placed in a congenial atmosphere, it would have thrown out fungi.

NAUTICUS.

P. S.—In my former letter are the under-mentioned errata:—

P. 150, col. 1, line 10, *seeded* should be *sided*; ditto, line 31, *plane* should be *pane*.

BALLOON GOVERNOR.

Percy-street, April 26, 1824.

GENTLEMEN;—As the return of summer has again brought aërostation into vogue, I would propose an appendage to balloons, which, if properly used, would, I think, be of material advantage to aëronauts. The object of it is to give them a complete command over the material which floats them aloft, so that they may be able to ascend or descend at pleasure. Every one knows that the cause of a balloon ascending is because it is filled by a gas which, though it occupies as much space as the atmospheric air, is yet specifically much lighter, so that when as large a body is collected as suffices to displace a little more atmospheric air than the weight of the balloon and appendages, it rises as a matter of course. Now, suppose a small balloon, of about three or four feet diameter, made very strong, were connected with the main balloon, by a pipe with a condensing apparatus; the air could be drawn off from the large balloon, and condensed in the little one, in which case the former, as it would displace less atmospheric air, would necessarily descend. Again, when the aëronaut wished to re-ascend, by opening a cock communication, the condensed air would immediately rush back, and the balloon mount as before. The weight of this governing apparatus need not exceed a few pounds. S. M.

BALLOON SAFETY HOOP.

George-street, Shoreditch.

GENTLEMEN;—The fate of the late unfortunate Mr. Harris has revived in my mind a plan which occurred to me a considerable while ago, for securing balloons from the danger attendant on the escape of the gas or other air by which they are inflated, which, had it been adopted, would not only have saved his life, but probably have brought him down unhurt.

I propose that there should be a hoop made of cane or whalebone, about three quarters of an inch thick, and large enough to circumscribe the largest part of the balloon, when inflated, and that it should be well secured, both to the net and the balloon itself, by strings placed at small distances. In the event of the gas escaping, this hoop would keep the parts still sufficiently distended, and act as a parachute of large dimensions, ensuring a gentle descent, and the perfect safety of the aëronauts.

If any of our balloonists should think so well of this plan as to adopt it; I shall desire no other recompense than to go a voyage with them, being quite willing to risk my own life on the merit of my cane hoop.

Your constant reader,
E. W.

SOCIETY OF ARTS.

ANNUAL DISTRIBUTION OF REWARDS.

Wednesday, the 26th of May, being the day appointed for the annual distribution of the rewards adjudged by this Society, a very numerous and respectable company assembled to witness the ceremony at the King's Theatre, Haymarket. His Royal Highness the Duke of Sussex, who is President of the Society, personally distributed the different premiums. The following were given for discoveries and improvements

In Mechanics.

1. To Mr. F. Watt, for a screw-wrench, Ten Guineas.
2. To Mr. T. Eddy, 354, Oxford-street, for a screw-wrench, the Silver Vulcan Medal.
3. To Mr. G. Gladwell, 4, Lower Garden-street, Vauxhall, for an improved plane for carpenters, Five Guineas.
4. To Mr. G. Welsh, 12, Mount-street, Walworth-common, for an original screw, the Silver Vulcan Medal and Ten Guineas.
5. To Mr. J. Duce, Wolverhampton, for a quadruple lock for safe chests, &c. the Silver Vulcan Medal and Ten Guineas.
6. To Ed. Speer, Esq. 7, New Inn, for concentric chucks for turners, the large Silver Medal.
7. To Captain Bagnold, 7, High-row, Knightsbridge, for an improved culinary steam-boiler, the Silver Vulcan Medal.
8. To Mr. J. Aitkin, St. John-street, Clerkenwell, for a remontoire escapement, Twenty Guineas.
9. To Mr. J. Bothway, Devonport, Plymouth, Gunner in the Royal Navy, for an apparatus for raising invalids in bed, the Silver Vulcan Medal.
10. To Mr. J. Stirling, Glasgow, for a set of working drawings of a steam-engine, the large Silver Medal or Twenty Guineas.
11. To Mr. R. W. Franklin, 92, Tottenham Court-road, for an improved mode of feeding the boilers of high-pressure steam-engines, the large Silver Medal and Fifteen Guineas.
12. To T. Bewley, Esq. Montrath, Ireland, for an improved mode of heating manufactories, the large Silver Medal.
13. To Mr. F. Richman, 35, Great Pultney-street, for a method of raising a sunken floor, the large Silver Medal.
14. To Mr. A. Ainger, Everett-street, for his mode of supporting beams or other timbers, the ends of which have become decayed, the large Gold Medal.
15. To Mr. R. Soper, Royal Dock-yard, Devonport, for a pitch kettle and ladle for paying the seams of ships, Ten Guineas.
16. To Mr. W. P. Green, Lieut. R. N. for improvements in working ships' guns, the large Silver Medal.
17. To To Mr. R. C. Clint, for his balanced masts, the large Silver Medal or Twenty Guineas.
18. To G. S. Barton, Esq. Capt. R. N. for his improved mode of casting an anchor, the large Silver Medal.
19. To Mr. W. J. T. Hood, Lieut. R. N. for his improved quadrant for naval use, the Gold Vulcan Medal.

20. To Mr. G. Smart, Pedlar's Acre, Lambeth, for an improved mode of supporting the topmasts of ships, the Gold Vulcan Medal.

For Drawings of Machines.

21. To Mr. J. B. Watson, Surbiton-hill, Kingston, for a perspective drawing of a crane, the Silver Isis Medal.

22. To Mr. P. W. Barlow, Woolwich, for a perspective view of a transit theodolite, the large Silver Medal.

For Medalling, Casting, &c.

23. To Mr. G. Presbury, 12, Donsell-street, for a finished historical engraving, the large Silver Medal.

24. To Mr. Ed. Raddlyffe, Birmingham, for an etching of animals, the Silver Isis Medal.

25. To Mr. S. Clint, Rolls Buildings, for an original medal die of a head, the large Silver Medal.

26. To Mr. James Howe, Little Tufton-street, for an original whole-length miniature in wax, the Silver Isis Medal.

27. To Mr. Edm. Turrel, 46, Clarendon-street, for an improved menstruum for biting in on steel plate, the large Gold Medal.

28. To Mr. J. Straker, Redcross-street Cripplegate, for a new mode of embossing on wood, the Silver Isis Medal and Ten Guineas.

For Architectural Drawings.

29. To Mr. G. Wetten, 19, Bryanstone-street, for a design for London Bridge, the Gold Medallion.

30. To Mr. Henry Roberts, Camberwell-terrace, for a design for London Bridge, the large Silver Medal.

31. To Mr. J. D. Paine, 29, High-street, Bloomsbury, for a design of London Bridge, the large Silver Medal.

32. To Mr. G. Parminter, jun. 19, High-street, Blackfriars, for a perspective view of St. Paul's, Shadwell, the large Silver Medal.

33. To Mr. J. B. Watson, Surbiton-hill, Kingston, for an original design for houses, in Greek architecture, the Gold Isis Medal.

34. To Mr. G. T. Andrews, 29, Lower Brook-street, for an original design for houses, in Greek architecture, the Silver Isis Medal.

35. To Mr. T. Plowman, Oxford, for an original design for houses, in Greek architecture, the large Silver Medal

36. To Mr. P. H. Desvignes, 15, Hunter-street, Brunswick-square, for a perspective view of Pancras New Church, the Silver Isis Medal.

37. To Mr. J. G. Welford, jun. 27, South-street, Grosvenor-square, for a perspective view of a Corinthian Capital, the Silver Palette.

38. To Mr. W. Morris, 26, St. Paul's Church-yard, for a perspective view of a Corinthian column, the Silver Isis Medal.

39. To Mr. Henry Roberts, Camberwell-terrace, for a perspective drawing of a Corinthian Capital, the large Silver Medal.

For Improvements in Chemistry.

40. To Mr. R. W. Dickinson, Albany Brewery, Kent Road, for a machine for clearing beer while in fermentation, the large Silver Medal.

41. To Mr. H. Wilkinson, 12, Ludgate Hill, for an improved safety chamber to the oxy-hydrogen blowpipe, the large Silver Medal.

42. To Mr. T. Griffiths, Church-street, Kensington, for an improved stop-cock for chemical purposes, the Silver Vulcan Medal.

43. To Mr. G. Chapman, of Whitby, for a mode of consuming the smoke of steam-engine boilers, the large Silver Medal.

For Improvements in Manufactures.

44. Sixteen premiums for bonnets made of British grass, in imitation of Leghorn.

45. To Mr. P. Caron, Spitalfields, for preventing silks from being watered in the loom, Five Guineas.

The other premiums awarded were for Improvements in Agriculture, and Rural Economy—Original Oil-paintings, and Copies in Oil—Original Paintings, and Copies in Water-colours—Original Drawings, and Copies in Chalk, Pencil, and Indian Ink—Drawings from Statues and Busts—Models in Plaster, and Colonial Products.

ANSWERS TO INQUIRIES.

No. 16.—DEPOSIT IN STEAM BOILERS.

Gentlemen;—Your correspondent H. B.'s inquiries respecting the deposit of lime, &c. and other matters in steam-boilers, brought to my recollection a circumstance which occurred to myself some years back. Perhaps it may prove a cure to the evil complained of, or suggest an equally simple remedy. I complained to a friend, that the water used for tea, occasioned a lime deposit, which required frequent scraping to remove; otherwise it became a perfectly hard sort of stone. My friend told me, if I put a common marble, such as children play with, in my kettle, by its motion, or some other cause of which he was ignorant, it would prevent the evil of which I complained. Speaking some time after of this to another person, he informed me, that in his family they merely put an oyster-shell in, which they found prevented the furring of their tea-kettle.

A Lover of useful Inquiry.

Another correspondent (C. H. G.) offers a similar suggestion, and adds, "I am told, that when a kettle is very much furred, by putting it on the fire till quite hot, and then pouring in cold water, it will dislodge the fur."—The most satisfactory answer, however, seems to be that which follows:

Woolwich.

Gentlemen;—I beg leave to call the attention of H. B. to the following facts, which are extracted from Dr.

Brewster's Magazine, as communicated by Robert Bald, Esq. F. R. S. E. In collieries, where the common steam-engine is applied for drawing water from the mines, it frequently happens that, after a continuance of wet weather, the water accumulates so fast as to require the engine to be worked night and day. In this case a great quantity of earthy matter is brought immediately from the surface, which renders the water within the boiler very muddy; and there being little time for cleaning the boiler, owing to the accumulated water in the mine, six or eight weeks sometimes elapse before this can be done. Towards the end of this period the water in the boiler is mixed with sediment to such a degree, that the ordinary supply of steam cannot be raised, although the fire is increased in the furnace. The consequence is, that the common working speed of the engine is greatly reduced; and in this case it has been the constant practice of the engine-keepers in *Scotland* to apply a very simple remedy for increasing the quantity of steam.

The substance employed is known by the name of *comings*, being the radicles of barley, produced in the process of malting, which are separated before the malt is sent to market. About a bushel of these is thrown into the boiler, and when the steam is again raised, an immediate effect is visible; for there is not only a plentiful supply of steam to produce the full working speed of the engine, but an excess of it going waste at the safety valve: this singular effect will continue for several days. Such is the fact; but the principles by which the vegetable matter acts are not very obvious, as it is doubtful whether it acts chemically or mechanically. If its action is mechanical, chaff or saw-dust may produce the same effect.

In the distillation of ardent spirits upon a greater scale, it is found necessary, when converting the fermented liquor or wash into low wine, to throw a quantity of soap into the still every time it is charged or filled, which has the effect of causing the steam to rise more quickly and more disengaged from the residuary matter. We do not, however, see any analogy between this process and the effect produced in the engine boiler before mentioned.

The sediment, in boilers, produced after wet weather, is chiefly composed of clay, and does comparatively little injury to the boiler; but in general the common mine water which percolates very slowly through the strata, produces a sediment of *sulphate of lime*, which adheres so closely to the bottom of the boiler, that it cannot be removed but by punching it off with a sharp iron instrument, and this sediment, when removed, has frequently a thin scale of the iron plate of the boiler adhering to it. In this way the boiler is not only injured, but, if the sediment accumulates at any part of the bottom, the plates are liable to become red hot at the place which greatly injures them.

To lessen these injurious effects, it is the practice to throw into the boiler a quantity of peat earth in its natural plastic state, which is found to have a considerable effect in preventing the sediment from adhering so closely to the boiler plates.—I am, Gentlemen, your obliged humble servant,

James Marsh.

INQUIRIES.

No. 18.—DRIVING A DESCENDING GALLERY.

Gentlemen;—Can any of your correspondents oblige me with a clear mathematical demonstration of the following problem, which has hitherto, I believe, never been satisfactorily determined:—In driving a descending gallery, whether should the stanchions be placed perpendicularly to the horizon, or to the slope of the gallery; or, in other words, by which of those two methods will they bear the greatest pressure?

A Military Engineer.

Chatham.

IRON AND STEEL.

The manufacture of iron has been brought to such a pitch of perfection in Sheffield, that articles of cutlery are now made there of cast iron, of a polish equal to the best cast steel, and so sharp edged, that the most experienced workmen are at a loss, by mere inspection, to distinguish them from articles of genuine steel. The following is a very simple

Test to distinguish Iron and Steel.

Dilute a quantity of nitric acid with so much water that it will only feebly act on the blade of a common table-knife; let a drop of the acid thus diluted fall on the metal to be tried; and after it has remained upon it for a few minutes, wipe it off. If the metal is steel, the acid will have left a black spot; if iron, a spot of a whitish grey colour.

To know the Quality of Steel.

It frequently happens that articles of considerable value intended to be fabricated in steel, are not known to be defective until after much expense has been incurred in manufacturing them. Steel which abounds with spots, veins, or specks, will not show its defects until the final operation, when the attempt is made to finish and to polish the work. Other articles of steel, such as delicate measuring or micrometer screws, blades of the best kinds of shears, fine circular cutters, engravers' tools, surgical instruments, &c. either bend and lose their shape in the hardening, from the difference of expansion, or exhibit other incurable defects when they come to be tried.

To enable the manufacturer to ascertain with certainty at the first the quality of the steel he is going to employ, let him clean the rough article with a file, and wash it with nitric acid, in a very dilute state; the parts which contain the greatest portions of carburet of iron will immediately show themselves by their dark colour, and thus enable the manufacturer to form a perfect judgment of the uniformity of the article.

Another Test.

To choose the best steel for making cutting instruments, such as gravers, punches, turning tools, chisels, &c.

Draw one end of a bar into a small rod under a low heat, a dull red, for instance, or a little above; after letting it cool, heat it again as before, and suddenly plunge it into pure cold water; if it prove hard, and require a great force to break it, it is good, *let its fracture be what it may.* This circumstance deserves particular attention, as workmen in general reject such steel as breaks with a coarse fracture, even though it be of such a quality as to require a great force to break it, while being hardened.—*Mr. S. Varley—Philosophical Mag. Vol. II.*

TRYING GOLD.

In Africa, where gold-dust is an article of commerce, it is often adulterated with those varieties of pyrites which approach the nearest to it in colour, and not unfrequently with brass filings. The merchants appear not to know how to detect these intermixtures, and from the want of this knowledge, many have suffered great loss. Some of the better informed negroes make a trade of "trying gold," and are called "tryers;" and slight as their knowledge is, they are generally able to save those who resort to them, and pay sufficiently for their fidelity, from any gross imposition. It is needless to say how preferable it would be were every merchant qualified to be his own "tryer," and this he may easily be. Let him put a few of the particles into a watch-glass, drop a little of any acid into it, and hold it over the flame of a lamp or candle until an ebullition is produced; if the particles are genuine gold, no alteration whatever will take place; but if spurious, an effervescence and change of colour will be the result, showing that the substance is acted upon by the acid, which gold never is. If the dust, as proved by this test, is spurious, the fact may be still farther confirmed by throwing the contents of the watch-glass into a tumbler of water, and adding a few drops of prussiate of potash, when the mixture will be found to assume a beautiful blue colour, in consequence of the iron of the pyrites being redeemed from the solution by its affinity to the alkali.

TEST FOR PRUSSIAN BLUE.

To know the value of any particular sample, break it, and observe the appearance of the fracture; if of a downy dulness, it is a sign that the colour is good; if glossy, a sign of the reverse. The comparative value of two samples may be also determined by weighing them; the lightest will always prove the best.—*Chaptal—Packer's Dyers' Guide.*

A GOOD BREAD.

A mixture of two parts flour, and one potatoe, makes an agreeable bread, which cannot be distinguished from wheaten bread. It is said that not less than 300 tons of potatoes are consumed for this purpose in London every week.

Perhaps the quality of the bread is not much injured by this practice; for it is a fact, that those who employ potatoes to the greatest extent, are, generally speaking, the bakers in greatest repute. The grievance is, that the same price is taken for a potatoe loaf as for a loaf of the finest wheaten flour, though it must cost the baker much less.

SPURIOUS PEPPER.

An artificial pepper has lately found its way into this country from France, and been hawked about with considerable success. It consists of the grains of the *brassica napus*, over which a paste, made of flour, mixed with a little powder of Cayenne pepper, or mustard-seed, has been carefully laid and dried. The imposition may be easily detected by splitting the grains, when the artificial nature of their texture will be at once apparent.

EXTRAORDINARY WELL.

When Pope Clement VII. was at Orvieto, in 1528, having noticed the scarcity of water to which the city was liable, it being built upon a rock at a distance from any spring, he caused a large well to be cut through the solid rock, to the depth of 265 feet, and 25 ells wide. It has two flights of hanging steps, one above the other, to ascend and descend, executed in such a manner that even beasts of burthen may enter, and by 248 convenient steps arrive at a bridge, placed over a spring of water; and thus, without returning back, they arrive at the other stairs, which rise above the first, and by these return from the well by a passage different from the one they entered. The Pope had a medal struck on this occasion, representing Moses striking the rock for water.

NEW PATENTS.

To Alexander Dallas, of Northumberland-court, Holborn, engineer; for his machine to pick and dress stones of various descriptions, particularly granite stone.—April 27, 1824—6 months.

To John Turner, of Birmingham, brass and iron-founder; for his machine for crimping, plaiting, and goffering linen, muslins, frills, and other articles.—April 27, 1824—2 months.

To James Viney, of Shanklin, Isle of Wight, Colonel in the Royal Artillery; for certain improvements in and additions to water-closets.—May 6, 1824—6 months.

TO CORRESPONDENTS.

The first of a series of familiar Essays on Geometry, as connected with Mechanics, in our next.

"A Man in the Moors" is informed that an answer to the question referred to is still wanted. His remarks on ascertaining the power of Steam-engines shall have an early place.

We thank G. A. S. for his prompt and able co-operation.

The letter from Captain Manby inserted in our last, must, we presume, have satisfied W. R. of the propriety of dropping the subject.

"A Constant Reader" will obtain the List he wishes, by application at the house of the Society of Arts in the Adelphi. He mistakes, we think, our lists of patents for lists of prizes. A person may take out a patent for almost any new thing he pleases, without any regard whatever being had to its real merits; and it often does happen, that patents are obtained for the silliest things imaginable. Sir Isaac Coffin, for instance, took out a patent lately for a new method of catching mackarel; and this new method consisted, not in first tickling them under the gills, but in employing two lines with common hooks affixed, and while one is sinking, pulling the other in! Where prizes are given by any public body, *merit* is always a *sine quâ non*.

Descriptions of a Brake for Barking Willows—of a plan for laying down Water-pipes, and constructing a durable Street—of an Alarum Apparatus by W. H.—of an Improvement on the Lathe by Omega—of a Soldering Machine by a Goldsmith's Apprentice — of a Clock Lamp by Mr. Peck—and of a Horizontal Cylinder and Piston by A. M'Voy, are all intended for insertion.

Communications received from A Subscriber—Oiseleur—C. C.—A Member of the Philotechnic Society—A. R. Y.—Simon B.—H. M. J.—T. T. Simpson—Inquirer—Alpha—Screw—T. T.—W. Miller—G. R.—and Michael.

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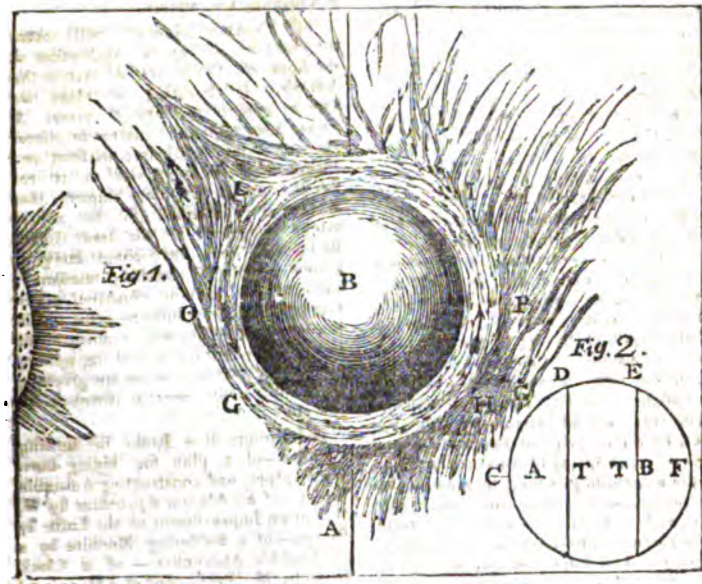
It is not, my friend, in figures of *arithmetic alone* that gain presents itself before us. . . . Fortune is the goddess of breathing men; to feel her favours truly, we must live and be men, who toil with their living minds and bodies, and enjoy with them also. —*Wilhelm Meister*.

No. 42.] SATURDAY, JUNE 12, 1824. [Price 3d.



RISE AND FALL OF THE BAROMETER WITHIN THE TROPICS.

April 21, 1824.

GENTLEMEN;—I am particularly obliged by your furnishing us with a more complete account of the periodical rise and fall of the barometer within the tropics. I have not, however, been able to devote any time to investigate this subject, until within a day or two; nevertheless, I will comply with *Investigator's* request (p. 71, Vol. II), and endeavour to give such a view of the subject as, in my humble opinion, seems to point out the real cause of this effect.

From a careful perusal of the account before noticed, this periodical variation appears (as I anticipated) not to be the result of any atmospheric change as regards the weather, but to arise solely from another cause, regular and uniform in its action, by which the whole equatorial region is affected, more or less, as it comes respectively under its influence.

I assumed hastily, on a former occasion, immediately on reading an indistinct newspaper paragraph, that the greatest heights of the barometer would be, at six o'clock at night, and six in the morning, and the greatest depressions at noon and midnight; this, however, from the subsequent information you have kindly favoured us with, appears not to be correct. The error arose from my not taking into consideration the compound motions of the earth, having only considered the effect of its orbicular motion in a fluid of extreme rarity, without allowing for the effect of its diurnal motion.

Figure 1 represents the earth travelling in its orbit, through space, in the direction A, revolving on its axis B, in the direction of the arrows seen in the atmosphere, the area of the square representing a portion of space, supposed to be filled with matter of inconceivable rarity. The earth in passing through this fluid with its immense velocity, condenses or compresses together all the atoms immediately opposing its progress, as exhibited on the fore part of the atmosphere at E. That form of compression however would not have taken place, had not the earth revolved on its axis; it would have been that of a cone of incurved sides, the fluid escaping uniformly over the globe in all directions from its apex; but the earth's diurnal motion gives a different direction to the fluid; for the particles compressed on the fore part of the atmosphere, occasioned by its orbicular velocity, receive an impulse from the rotatory motion of the earth and atmosphere, by which they are driven, on accumulating, from G to H, thereby producing and giving direction to a volume or stream of condensed fluid (as regards itself) similar to that exhibited as passing over H. Hence it will be seen, from the direction given to this fluid by the earth's rotation, that at the side commencing at G, or three o'clock in the afternoon (the time of the greatest depression of the barometer), it is only struck by individual particles, from whence a progressive increase takes place to the point H, where the whole accumulated volume or stream acts with the greatest resistance, and which answers to our nine o'clock at night, when one of the extreme heights of the barometer takes place.

It is unnecessary to say much on the fall that follows; for, by referring to fig. 1, it will appear self-evident, that such an effect must occur when the fluid proceeding onward from the point H to I, or the point of three o'clock in the morning, recedes from the pressure of the stream to which it was there exposed; a progressive fall is inevitably the consequence.

Before proceeding further, I would notice that the earth, in rolling against this stream, appears to act, as it were, against a plane inclined to its orbit, which has a tendency to make it describe a curve that would ultimately bring it to the sun; counteracted, however, by centrifugal force, it cannot deviate from its orbicular track; hence it is probable that gravity has an assistant in giving it that direction.

But to proceed to the cause of the second rise of the barometer. From the immense velocity of the earth in its orbit, it follows that much friction takes place on the sides O and P, between the upper strata of the atmosphere, and the medium in which it has its course; and though the motion of the earth on its axis is favourable, by way of producing a diminution of such friction on the side P, yet the volume of accumulated matter on that side, acting by the superior velocity of the earth's orbicular motion in the direction of the inferior velocity of its diurnal motion, produces an increased velocity in the upper strata, which causes an accumulation not exactly behind, or in the lee of the globe; for the fluid is carried on by its impetus towards L, where it is resisted by the inferior stream passing by the side O, which, not being sufficiently powerful to drive the accumulated atmosphere behind the ball, passes off in the curved track marked by the arrow, thereby giving such accumulation a form similar to that seen at L; hence it will readily appear, by the regular increase of matter from I to L, and decrease from L to G, that the barometer must be proportionally affected in passing through these distances; therefore the superior weight of the atmosphere at L, will produce the second greatest height at nine o'clock in the morning, while the point G will be the second greatest depression.

We will now examine why this effect is confined to the region between the tropics. It may appear, from a hasty view of this circumstance, that the rise and fall of the barometer cannot be produced by the cause before described, as that would seem to spread its influence to a greater lateral distance than 23½ degrees on either side of the equator, especially when we consider the apparent great extent of surface, or number of degrees (66½) of latitude from the tropics to each pole. A little investigation, however, will soon convince us to the contrary, and prove that that cannot be the case. No more matter can strike the earth, or oppose its progress, than would be received on a circular plane of the same diameter. We shall find, by referring to fig. 2, where the lines T T represent the tropics 23½ degrees from the equator, that the united areas A and B are only equal to the space contained between the parallels T T; consequently no more particles of matter can strike the whole of the spaces united without the equatorial region, than that space receives of itself, and on nearly a plane, as regards its lateral extent; hence it is that the greater part is carried forward (as before noticed) and discharged, as at M, fig. 1, by the earth's diurnal motion, while all those particles that fall on the higher latitudes are received on the inclined curved surfaces, as C D and E F, fig. 2, of great elevation: it follows, then, that any ray, as at G, falling on the inclined curved surfaces, perpendicular to the axis, will not be carried round by the earth's rotatory motion, as under the equator, but will partake of that motion, and the effect of its action on such surface, by which a diagonal direction is given to it; and thus a great part of the matter falling on these spaces, will be discharged in its greatest volume, a little to the eastward of the poles, but probably not in a very condensed stream. Hence the reason why no sensible effect is felt without the tropics, or in the temperate zone, though there possibly may be a slight variation discovered near the poles.

I have now given you, Gentlemen, a probable hypothesis, expressed in general terms, relative to this phenomenon, which future observations and experience will either confirm or prove fallacious.

I should recommend barometrical instruments of a peculiar construction (unnecessary here to describe) to be sent to different places under the equator, and likewise to the poles, where, by careful and accurate observations for a few years, much information towards elucidating this subject might be acquired.

Gentlemen,

Yours respectfully,

Wm. Gilman.

MR. PERKINS' STEAM-ENGINE.

"Inquirer" requests that we will explain how it is that water issuing from Mr. Perkins' generator flashes into steam at 600 degrees less of heat than is usually necessary to convert water into steam. We shall give the explanation in Mr. Perkins' own words:—

"To explain how this additional heat was obtained, I must describe the form of the first generator. This generator was cylindrical, 17 inches external, and 12 inches internal diameter; 22 inches long, and each end three inches thick; it stood on one end, and worked best when enveloped in fire. In that case, although the fuel was equally applied, the top became much the hottest, owing to *the carrying property of water*, which greatly contributed to the success of the experiment. As the mass of metal at the top, where the heated water passed from under the loaded valve, became much hotter than the average of the metal or water, it served as a reservoir of heat to give to the hot water as it passed through it, enough additional heat to effect the complete conversion of water into vapour. This supply, however, was limited; for if the stop-cock, which was also at the top, was opened, only to a certain distance, pure steam would continue to issue; but a little larger opening would admit steam and water, from the want of a sufficient supply of heat to convert the whole into steam; and in one instance the head of the generator, two inches from the stop-cock, was lowered 200 degrees in less than one minute."

COMBINATION LAWS.

The Bill for the repeal of these laws has passed the House of Commons, without any serious opposition having been offered to it; and we shall be happy to find that it encounters as little difficulty in the Upper House. An attempt, however, is making in the eleventh hour by a daily paper of the first respectability, and very extensive influence, to excite an alarm as to the probable consequences of the measure, which may possibly be of some prejudice to its progress. The House of Peers is not, in our opinion, the least liberal or enlightened portion of our legislature; yet there is still enough of the old blind antipathy to every thing in the shape of change and innovation lingering on its benches, to make one afraid of what an artful and noisy appeal to this feeling may accomplish.

The point on which the opposition of *The Times* turns is, the probability that the repeal of the Combination Laws will only serve to legalize and strengthen many dangerous combinations which now exist among workmen. It quotes, by way of proof, the evidence of Mr. Place, with respect to the existing combination among the tailors of London; and does us the honour of appending the observations that we felt it necessary to offer on that evidence. That the account given by Mr. Place of this dangerous confederacy, and the tone of exultation in which he seemed to contemplate it, would be made a handle of, in opposition to the repeal of the Combination Laws, is just what we from the first anticipated; and now, with more reason than ever, may we repeat the words we used on the occasion — "Depend upon it, mechanics, should you now fail in your endeavours to obtain the abolition of the truly obnoxious Combination Laws, it will be these military tailors who have undone you."

As we have before repeatedly said, although we advocate the repeal of the Combination Laws, it is not *in order that combination may be produced*, but that it may *be done away with entirely on the part both of masters and men*, and things left to find their natural level. We have a suspicion, nay we know, that many of you do secretly look forward to the repeal as a measure which will enable you to combine at pleasure, and have all your own way. But as sincere, tried, and unalterable friends to your interests, we entreat you to dismiss utterly from your minds every desire, every hope of the kind. We entreat you to do so, because it is what all your best friends expect from you,—what those who have carried the measure thus far triumphantly forward,—what Mr. Hume, Mr. Huskisson, Mr. Robinson,—the whole Committee, in short, from whom the measure emanated—expect at your hands. We entreat you to do so for this reason more especially, that should it be the effect of the nearly accomplished repeal of the Combination Laws to strengthen old combinations and produce new ones—to encourage more than hitherto associations of workmen against their masters—to produce evil rather than a good; then, to a certainty, either the old laws will be restored (never again perhaps to be repealed) or new ones will be enacted, still more rigorous and severe in their operation. In order to make perfectly clear to you the real state of opinion on the matter, we subjoin a full copy of the Report of the Committee (of which we gave only an abstract in our last) on the subject of these laws. You will see from this, that the Committee most distinctly and unequivocally agree with us in condemning all combination whatever, and that it is only because they conceive the existing laws *against* combination have *not that effect*, but, on the contrary, tend to give a more "violent character" to the combinations than they would otherwise have, that they recommend that they should be repealed. It is for "perfect freedom" they and we contend—that freedom "which ought to be allowed to each party of employing his labour or capital in the manner he may deem most advantageous," to the utter exclusion of all "threats, intimidation, or acts of violence," of which nature every combination of numbers to work only at a certain price must necessarily be.

Mr. Place has done harm to your cause by his evidence, and he could not make better amends than by procuring (which he can easily do if he please) a new petition from the journeymen tailors of the metropolis to the House of Lords, praying for the repeal of the Combination Laws; but disclaiming, at the same time, all intention, in the event of such repeal, of upholding that extraordinary system—that "all but military system" of combination in which they are at present linked, and declaring their determination to know nothing henceforth of "executives of five," or any other such revolutionary substitutes for individual free-will. But since there is no hope, that with the crooked opinions which Mr. Place entertains, he will be instrumental in procuring any thing of the kind, we trust the tailors will think and act for themselves on the occasion; and without waiting his bidding, will forthwith state frankly and honestly, whether the sort of example which they intend to set to the other working classes of the community, when the repeal is passed, is such as corresponds (we hope it does) with the sound and liberal principles on which the legislature is proceeding in enacting that repeal. A few petitions of similar import from other bodies of journeymen would do no harm.

SIXTH REPORT OF THE COMMITTEE.

The Committee report,

1. That it appears by the evidence before the Committee, that combinations of workmen have taken place in England, Scotland, and Ireland, often to a great extent, to raise and keep up their wages, to regulate their hours of working, and to impose restrictions on the masters respecting apprentices or others, whom they may think proper to employ; and that at the time the evidence was taken, combinations were in existence, attended with strikes or suspension of work; and that the laws have not hitherto been effectual to prevent such combinations.

2. That serious breaches of the peace and acts of violence, with strikes of the workmen, often for very long periods, have taken place, in consequence of, and arising out of the combinations of workmen, and been attended with loss to both the masters and the workmen, and with considerable inconvenience and injury to the community.

3. That the masters have often united and combined to lower the rate of their workmen's wages, as well as to resist a demand for an increase, and to regulate their hours of working; and sometimes to discharge their workmen, who would not consent to the conditions offered to them; which have been followed by suspension of work, riotous proceedings, and acts of violence.

4. That prosecutions have frequently been carried on under the statute and the common law against the workmen, and many of them have suffered different periods of imprisonment for combining and conspiring to raise their wages, or to resist their reduction, and to regulate their hours of working.

5. That several instances have been stated to the Committee of prosecutions against masters for combining to lower wages, and to regulate the hours of working; but no instance has been adduced of any master being punished for that offence.

6. That the laws have not only not been efficient to prevent combinations, either of masters or workmen; but, on the contrary, have, in the opinion of many of both parties, had a tendency to produce mutual irritation and distrust, and to give a violent character to the combinations, and to render them highly dangerous to the peace of the community.

7. That it is the opinion of the Committee that masters and workmen should be freed from such restrictions as regard the rate of wages and the hours of working, and be left at perfect liberty to make such agreements as they may mutually think proper.

8. That, therefore, the statute laws that interfere in these particulars between masters and workmen, should be repealed; and also that the common law under which a peaceable meeting of masters and workmen may be prosecuted as a conspiracy, should be altered.

9. That the Committee regret to find from the evidence, that societies legally enrolled as benefit societies, have been frequently made the cloak under which funds have been raised for the support of combinations and strikes, attended with acts of violence and intimidation; and, without recommending any specific course, they wish to call the attention of the House to the frequent perversion of these institutions from their avowed and legitimate objects.

10. That the practice of settling disputes by arbitration between masters and workmen has been attended with good effects, and it is desirable that the laws which direct and regulate arbitration, should be consolidated, amended, and made applicable to all trades.

11. That it is absolutely necessary, when repealing the Combination Laws, to enact such a law as may efficiently, and by summary process, *punish either workmen or masters, who by threats, intimidation, or acts of violence, should interfere with that perfect freedom which ought to be allowed to each party, of employing his labour or capital in the manner he may deem most advantageous.*

MECHANICAL GEOMETRY.

It is well known to those who have the superintendance of manufactories, that those workmen who, to use a technical term, are *acquainted with lines*, that is, those who have some knowledge of geometry, are invariably the most ready and skilful workmen. Is it not much to be regretted, therefore, that from the excessively learned air assumed in the different treatises on Geometry, they are for the most part above the comprehension of those to whom they might be most practically beneficial, or at least so hard to comprehend, that men who have little time to spare for study, shrink from the attempt? It does appear to me, that if by divesting the science of this lofty obscurity, by any familiar mode of demonstration, we can make the valuable truths in which it abounds more extensively known among those who can best reduce them to practice, we shall be far from meriting a repetition of those sarcasms and severe remarks that were lavished on one who some years since instituted a course of lectures with a similar view. I allude to the lectures delivered by Mr. Donn.

The object I have in view is twofold—that of endeavouring to stimulate a most useful, but till lately a neglected individual of the community (I mean the working mechanic) to a taste for the science of geometry, which I am sure will most materially assist him in the business (let it be what it may) in which he is engaged; and next, that the appearance of the present paper may induce some abler pen to assist in the laudable task of making the sublime and beautiful, as well as useful truths of geometry evident to the humblest capacities.

I shall proceed first to lay down a few definitions, which are necessary to place the subject on a firm basis.

Definitions.

1st. A point is *geometrically* considered as an assignable place in a quantity, or line, or a limit of extension, and *mechanically* it is that mark left by the point of a tracer or punch that limits the extent of a line, or division of a line, and is of itself of no magnitude, at least when compared to the line measured, being merely the termination of that line.

2nd. A line is *geometrically* considered as produced by the motion of a point, and has length without breadth; and *mechanically* as the mark left on any surface by a tracer or pencil, and is either a straight line or a curve.

3rd. A straight line is that *mechanically* produced by drawing a tracer or pencil along the edge of a piece of wood or metal, known by workmen by the term straight edge, or by a tightly extended string, called a chalk line.

4th. Curve lines are either circular as produced by one leg of a pair of compasses, eliptical, or oval, by means of a tramel or other instrument for that purpose. There are various other curves that may be called mechanically regular, as being capable of being described or drawn by appropriate instruments, such as the catenerian, by means of a flexible line suspended from its extremities; the cycloidal, by the revolution of a circular plate or wheel on a plane, &c. &c. All other curves are either formed by finding a number of points according to some known rule, and drawing a line through these points, or lastly, drawn by the eye, according to the workman's taste or judgment.

5th. An angle is the meeting of two straight lines drawn as a plane, and is greater or less as they are more or less inclined to each other. Thus we say in mechanics, that a carpenter's rule, when opened, forms an angle at the joint, which is greater or less as the rule is more or less opened.

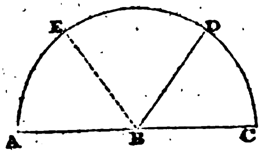
6th. Angles are either called right, acute, or obtuse; and are all measured by the parts of the circumference of a circle; the circle itself being supposed to be divided into 360 parts, called degrees. Now, to make this familiar to the mechanic, suppose a rule moveable in a joint, as the common carpenter's rule, and let it be opened a little way; the sides of the rule will then form an acute angle; now, if we open it till the two sides form what workmen term a square, the angle is then called a right angle, and the two sides are perpendicular to each other; and, lastly, suppose it opened beyond the square, the sides will then form an obtuse angle; and thus by moving round the joint at the centre, and according as the opening of the rule takes in more or less of the circumference supposed to be drawn from the joint as a centre, the angle will be greater or less till the rule is opened to its full extent, when it becomes a straight line, and the angle vanishes.

7th. Parallel lines are those which are every where equi-distant from each other, and such are the lines made by a gauge-mark set to different distances; each line is equi-distant from the edge against which the gauge runs, and are therefore parallel or equi-distant from each other; and thus also, if from one centre with greater or less openings we draw a number of circles, those circumferences are said to be parallel to each other.

I shall now, without proceeding further with the definition regarding planes or surfaces, proceed to some few useful propositions in which lines and anglesonly are concerned.

THEOREM I.

A right line standing on another right line makes both angles equal to 180 degrees, as it requires a semicircle to measure them.



Let A B C be a right or straight line, and B D another standing on it; it is required to prove that the angle D B C, added to the angle D B A, is equal to 180 degrees.

Open a carpenter's rule to its full extent, and lay it on the line A B C, the joint corresponding to the point B; now, if we keep one side of it, as A B, on the line, and let the other move about the centre B, till it coincides with the line B D, it forms an acute angle with the line B C, and an obtuse angle with A B, and has described part of a circle, as C D; and if it continues to move till the rule is shut, it will have described the semicircle C D A. Hence the angle D B C, together with the angle D B A, makes up the whole semi-circle, or is equal to 180 degrees.

We may hence deduce another truth, or, as geometricians call it, a corollary, viz. That if two or more lines stand in a straight line, all the angles about the point where they meet will be equal to 180 degrees; for the rule will, in its revolution, pass over E B as well as D B, before it completes the semi-circle A E D C.

(To be continued.)

CAPTAIN MANBY.

Gentlemen;—The readiness you have evinced to do justice, has induced me to request your insertion of the accompanying extract. My motive for intruding the subject again on your notice is, that it appears but proper to contradict by *facts* the assertions of your Mundesley correspondent, W. B.,* who, with probably every disposition to serve Captain Manby, has unfortunately in his last paragraph misrepresented the case.

Your obliged humble servant,
A Friend to Justice.

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* See No. 39.

Extract from the Report of the Select Committee, on Captain Manby's *Apparatus, for Saving the Lives of Shipwrecked Seamen. Ordered by the House of Commons to be printed, May* 16, 1823.

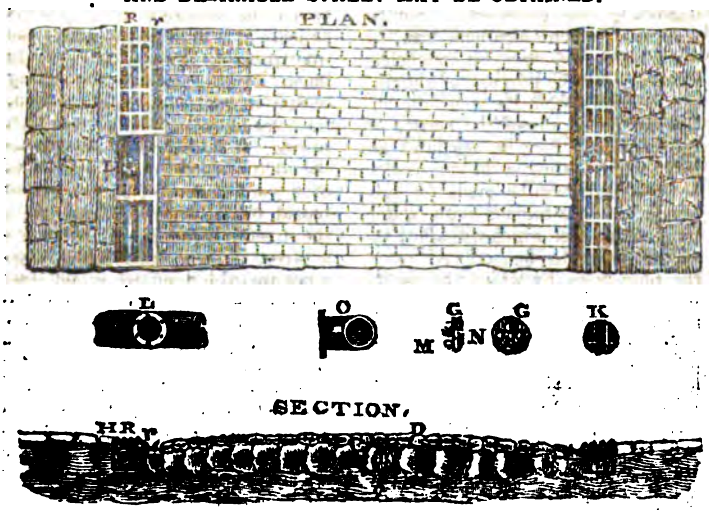
Captain G. W. Manby, *examined.*

When did you first turn your attention to the subject of saving persons from shipwreck?—I must beg leave to digress a little, to state when I first came into the country (Yarmouth); it was in the year 1803; there had not been a winter during which I had not seen several vessels wrecked; and in the year 1807, the Snipe gun-brig was driven ashore near the haven, which was not fifty yards from us; and by no exertion, or by no effect which was then known, could they effect a communication. They tried the means of veering away a buoy; the people tried to meet the line, by throwing over a lead line, but they could not effect any communication whatever, on account of the sweep of the tide and high raging sea; and after a lapse of five or six hours, we saw every soul perish! there were sixty-seven of them, and certainly not fifty yards from us: from that period, I was determined to turn my attention to it; at the moment, I said, "it is to be done by gunpowder;" but the received opinion was, that gunpowder had been repeatedly tried, and had never been effective. By a series of experiments, at length I brought it to bear, so that in the year 1808 I saved the first crew. But to prove that I had no idea of the plan having been previously discovered, I need only to state, that I should never have gone through the series of experiments and disappointments which annoyed my progress, had I known that Lieutenant Bell had projected the same idea; and I submit to the Committee, whether his project was at all practicable: he proposes that the apparatus shall be on board the ship, and the shot be fired from the vessel to the shore. Most of the instances of shipwreck that I have seen, the whole of the crew have been up in the rigging, and have there lashed themselves, to prevent being swept away, the sea breaking over them at the time. This circumstance will at once prove the impossibility of the application of his plan; a mortar could never be laid, and the necessary regularity of throwing the line would never be preserved; the gunpowder could not be kept dry, nor the means of firing it preserved.

Are you aware that a project of rescuing from shipwreck had been projected previously to your's?—*Never did I hear of it until after my having succeeded;* and I will further declare, that *I have never availed myself of any man's ingenuity;* the whole has been the result of my own mind and perseverance.

You never heard of people being saved from a vessel driven on shore in a storm by the projection of a rope, by the force of gunpowder, until carried into effect by you?—*Never, I solemnly declare.*

PLAN OF AN IMPROVED LINE OF SUBWAYS, BY WHICH A SMOOTH AND DESIRABLE STREET MAY BE OBTAINED.



Having devoted a considerable portion of time to the consideration of a plan for obviating the chief difficulties in obtaining a smooth and durable street; and having, in my opinion, matured one of that character, I take the liberty of submitting it to the judgment of the public, and of offering with it some few observations on the subject.

1. *The nature of the plan proposed.*—Its main object is to produce a durable street, and this is to be effected by removing the present causes of the premature decay of the pavement, and of the constantly recurring need of reparation. It will be readily admitted, that the defective state of the carriage-way pavement is referable to two principal sources; the first is, the imperfection of the original construction; the second, and most operative, is the perpetual disturbance of the paving in the laying down the pipes by the rival Water and Gas Companies. Since, then, the great evil has its origin in the position of the water and gas pipes, the appropriation of a different situation, with provision for easy access to them, without disturbing the carriage-way pavement, would offer this remedy, and is the basis of the proposed scheme. To effect this object, it is proposed to construct a line of trunks, sufficiently capacious to contain a line of water-pipe and a line of gas-pipe running parallel to each other; the situation to be appropriated to the trunks is to be the space extending from the curb-stone

of the foot pavement to the gutter or water-channel on each side of a principal street, or on one side only of a minor street. Here they are to be sunk, and the top covered and well secured. The trunks are to be made of cast-iron: the tops of the same material, with protruding knobs on the surface in resemblance of the paving stones, and bounded with a good gutter channel. These tops, by means of mechanical fastenings, will be removable at discretion, admitting of easy access to the pipes, and of as easy restoration, without in the least disturbing the pavement. Similar truncated communications can be made across the street at convenient intervals, for the purpose of running service pipes from the main on one side for the supply of the houses on the opposite. Circular openings are to be left for getting at the stop-cocks; and provision will be made for supplying the fire-engines with water, by a contrivance which will allow the suction-pipes to be screwed on to the plug-holes, by which the engine will receive an abundant supply, and its force be increased by the impulse of the water in the main. The general structure and particular parts of the plan will be found explained by reference to the drawing, and its accompanying explanation.

2. *The advantages resulting from the plan* will be very great. Its tendency to improve the state of the pavement is evident; for when the pavier's work is once well done, there would be no causes of its injury but the opening of the shores, and the decay from time and wear. The perpetual repairs now requisite will not be called for, and the public will have a durable street, free from dangerous inequalities; obstructions from broken-up pavement will seldom occur, and the adding of new, repairing old, or stopping leakage pipes, will be done with the utmost facility. The saving of repairs to parishes will be material; but to the water and gas companies the saving will be immense.

3. *Its applicability* to streets not yet completed, is presumed to be capable of demonstration; and an equal confidence is entertained as to such streets where iron-pipes have not yet been substituted for the wooden ones. How far this truncated system can be extended to other principal streets, experience of its benefits will determine; and it is suggested that the immense saving in repairs avoided, may make a gradual adoption of it in the principal streets a profitable enterprize

4. *Some idea of the expense* attending the execution of a given portion of the plan would be very desirable. The expense of a yard square of paving, of the common kind, is from twelve to seventeen shillings. The expense of a yard square of the cast-iron trunks is estimated at thirty shillings. It will, however, for the sake of easy reckoning, be taken at double the expense of a similar portion of paving. In laying down a new street, the additional cost of a line of paving of a yard wide, would be speedily repaid by the superior durability of the street. In adapting the plan to a street already made, and where pipes are to be removed or laid down, the expense of two, or at most three years repairing, incurred by the water-companies, would defray the cost; for it may be estimated that they repair annually a run of a yard and half wide through a principal street; this, in three years, gives a total width of 4½ yards of repair to set against the expense of 4 yards of the proposed trunks.

5. *Suggestions of the means of effecting the improvement* are offered with diffidence; for the inventor is aware of the difficulty of that part of the subject. But with an enlightened public, animated by an enterprizing principle, what that is useful cannot be accomplished? If a district constructs a street on this plan, they save the quick recurrence of repairs, and might equitably be empowered to call upon the Water Companies, running their pipes along the trunks, for a contribution from their savings in the expense of paving, which would, in consequence, accrue to them. Or might it not be profitable to the capitalists who would lay down these trunks, to receive a remuneration from the savings in the

paving rates of the district, and from the Water Companies using them?

6. *A more durable mode of forming streets*, in their origin, might be combined with, and would be assisted by this plan. To bestow any unusual trouble and expense on those works would be unavailing during the existence of the present system: the havock committed by the surface being immediately after the first formation, torn up by driving several lines of pipes beneath it, renders abortive any attempt at original good paving. Remove this evil, which is the object of the plan now submitted, and a superior mode of constructing new streets would be superinduced. Even if double the expense were bestowed, it would be repaid by a pavement ten times as lasting as that now made. The kind of road described in the drawing is proposed to be constructed of an additional under-layer of large unhewn stone, well bedded in earth. Without deciding on the merit of this mode, it may be pointed out as a matter of no surprise that the paving-stones sink into hollows, without the aid of other causes than the looseness of the earth on which they are laid: it generally consists of broken bricks, the refuse from cinder-hills, and uncementing rubbish of all descriptions. The surprise is, that no means have yet been adopted to reach the root of the evil by producing a better bedding surface for the superincumbent paving.

Explanatory Description of the Drawings.

Construction of the Trunks in which the Pipes are to be laid.

F, the trunks, being a series of box-like things, open at each end, and fastened together by screw-bolts. They will be of cast-iron, in pieces of about five feet in length; the width to be about three feet. Along these trunks the water and gas-pipes are to be laid. The whole will be covered over with the plate R, the surface of which will be made to resemble the protuberances of stones; on the outer edge will be a smooth curve *r* for the gutter or water channel. The covering plate is to be fastened by two flanches on each edge, four on the plate R, and the others on the corresponding edges of the trunk F, as is seen in the drawing below the letter H. At every fifth plate, the flanch or hook will be moveable on a pivot, so that it can be turned round by a winch, and the plates removed, in order to have access to the pipes.

L is a portion of the water-pipe, showing the section of a neck, arising from the pipe at O, nearly up to the under surface of the covering plate, with a flanch to fix the plate G to.

G is a round plate, with four screw-holes, as shown at N. In these holes, the hose or suction-pipes of fire-engines may be fastened. The plugs M are for stopping the water, and keeping the holes N clean. Thus, in case of fire, the water will be supplied out of the pipes immediately to the engine without any loss; by the present method five-sixths of the water runs to waste, and it is often exhausted before the fire can be extinguished.

Improved mode of constructing streets.

A, the excavated earth, forming the foundation of a new street or carriage-way.

B, a course of rough stones, of any kind, that can be most easily procured.

C, an inch and a half of gravel or earth to bed the paving-stones in.

D, the paving-stones of the usual size and quality commonly used.

The present way of making the foot-way pavement, when well executed, is smooth and durable.

LONDON MECHANICS' INSTITUTION.

The second General Quarterly Meeting of this Institution was held on Wednesday, the 2nd of June—

Doctor Birkbeck in the Chair.

The Minutes of last General Meeting having been read and approved, the secretary proceeded to read the following Report from the Committee of Managers:—

"Your Committee, anxious to procure what they have, from the commencement of their labours, considered the most important part of their duty, a suitable plot of ground, or premises, for the establishment of an Institution, have taken every possible means to obtain so desirable an object. The members, they trust, must be aware of the extreme difficulty under which they labour of procuring premises combining all those advantages that are so essentially necessary to the completion of the object they have in view. Since the last General

Meeting, the following places have been carefully examined.

[*Here followed a list of the places examined.*]

"From these your Committee have hopes to be able to select one that will be available for every purpose of the Institution, and it is their intention to call a public Meeting purposely to lay before the members such arrangements as will enable them to complete so desirable an undertaking.

"The necessity in the interim of having officers to transact the business of the Institution, to receive the various presents of books and donations, to enable their secretary to receive those gentlemen who honour the Institution with their countenance and support, to transact the business of the Committee, as well as to concentrate all the property of the Institution, under the careful superintendance of their own officers, made it most imperative on the Committee to find some central situation for these purposes. A suite of offices on the ground-floor of No. 15, Furnival's Inn, Holborn, appeared to your Committee well adapted for that object, and they have taken the same at a moderate rent, as a temporary accommodation, until suitable premises are provided for the Institution.

"To render the lectures more really useful, and of that value and importance they so justly deserve, your Committee have availed themselves of an opportunity of purchasing a very valuable set of apparatus and philosophical instruments, late the property of Mr. Tatum, of Dorset-street, Salisbury-square; they comprise instruments and models to illustrate the various branches of mechanics, hydrostatics, hydraulics, electricity, galvanism, optics, astronomy, aërostation, magnetism, and chemistry, as well as a collection of metals and minerals to elucidate the sciences of metallurgy and mineralogy. Your Committee have every reason to expect, from the very able Report made by their Sub-Committee, that the terms at which they were purchased, viz. 250 guineas, is very far short of their real value. Nor can they help expressing their conviction that Mr. Tatum, in his offer to the Institution, was actuated by a sincere desire to promote the great object they have in view, and was willing to make this sacrifice, in order that the great body of the mechanics of London (one of whom he is proud to call himself) might benefit by his labours.

"The several gentlemen who had offered their services to the Committee have been prevented, by unavoidable engagements, from giving those lectures that were mentioned in their last Report; but your Committee have great pleasure in announcing, that they are only in reserve, and that several other gentlemen of the first celebrity have offered their services in the interim. Mr. Dotchen, a member of the Institution, will commence a course of lectures on arithmetic and geometry, on Friday, the 11th of June, and Mr. Cooper will very soon commence a course of lectures on chemistry, as connected with the arts. Your Committee cannot pass over this part of their Report without expressing their great gratification at the disinterested support they have met with from the various professors of science who have honoured this Institution with their exertions, evincing that their wish to diffuse the knowledge of science is not surpassed by the zeal they display in the acquisition of it; and they are conscious that this truth will be equally felt by every member of this Institution.

"In conformity with the rules and orders, Article 60, the accounts have been laid before the auditors of all monies received and expended up to the 20th of February last, and their Report will be laid before you by one of the auditors, W. Ellis, esq.

"Your Committee feel certain that every member will feel proud to hear that their exertions have excited some degree of interest across the Atlantic, and that a communication from the Franklin Institute of Philadelphia has been received, which the secretary will read to you, and who is instructed by your Committee to return a suitable reply."

The Report then proceeded to state the different articles of receipt and expenditure during the past quarter. Of new members there has been an accession of upwards of one hundred; there have been also several handsome additions to the list of donations, among which are Sir Francis Burdett, 100*l*.; John Smith, Esq. M.P. 10*l*; John Abel Smith, Esq. 10*l*.; Martin Thos. Smith, Esq. 10*l*; Robt. Owen, Esq. 10*l*.; W. Birkbeck, Esq. 10*l*.; Professor Millington 5*l*. 5*s*. The balance in hand is 480*l*. 4*s*. 1*d*.

The Report also announced the presentation of a number of valuable books to the library of the Institution, including the Transactions of the Society of Arts, since its commencement, forty-one volumes, presented by the Society of Arts.* The announcement of this liberal gift was loudly cheered.

The Report concluded in these words: "Your Committee cannot conclude their Report without congratulating the members on the progress already made in furtherance of those objects so dear to the lovers of science and the general diffusion of knowledge. The interest already excited in behalf of the Institution, and the support it has received, will, they trust, be a stimulus to greater exertions, which will eventually lead to the most gratifying and beneficial results."

The Secretary next read the letter stated in the Report to have been received from the "Franklin Institute of Philadelphia." It is as follows:—

"Philadelphia, March 6, 1824.

"GENTLEMEN;—It becomes my duty to announce to you, that a respectable number of mechanics, and others friendly to the useful arts, principally residents of this city and county, have associated themselves together, and formed a Society, which is denominated, 'The Franklin Institute of the State of Pennsylvania.' The objects of this Institution are to encourage and improve manufactures and the arts, to disseminate among the labouring part of the community, who have not had the advantages of a liberal education, so much of scientific knowledge as is inseparably connected with their avocations, and to animate and assist the modest and humble artizan and manufacturer. To attain these objects, it is proposed to have delivered before the Society popular lectures upon the various branches of the mechanic arts, and upon those sciences which are intimately connected with them; to have exhibitions of the first production of the manufactories and workshops; to grant premiums to the most successful artist, and especially the youthful candidates; to make a collection of the most approved books and periodical works that treat on subjects connected with the arts, philosophical instruments, models of machinery, new and useful tools, mineral productions, and other materials used in the arts. To establish an impartial tribunal to judge of the merits of new inventions and discoveries, and to correspond with similar institutions in our sister states and in Europe, upon subjects connected with the Institution. Our constitution is not yet printed; as soon as it is, I shall have the pleasure of transmitting you a copy, together with a list of our officers for the current year.

"Any communications with which you may think proper to honour us, may be addressed to

"PETER A. BROWN, Corresponding Secretary to the Franklin Institute, No. 180, Chesnut-street, Philadelphia."

"To the Chairman of the London Mechanics' Institution."

Mr. STRATFORD moved, that the Report which the Secretary had read, should be received and approved of. The motion being duly seconded, was carried unanimously.

The Report of the Auditors, JOHN SMITH, Esq. M. P., GEORGE GROSE, jun. Esq., and WILLIAM ELLIS, Esq., was then read by Mr. ELLIS. It appeared from this, that the money in the hands of the Committee on the 20th February last, somewhat exceeded the receipts entered on their books.

The PRESIDENT observed, that the Society would perceive the error was *in favour* of the Committee, and not against them. It had no doubt arisen from the omission of the names of some subscribers or donors in the unavoidable confusion attendant on the first general meeting.

The Society next proceeded to the consideration of a motion of a Mr. Bowyer for a new law to this effect—that any forty members of the Society may, by a requisition in writing, request the Committee of Managers to call a General Meeting of the Institution, and that if the Committee shall decline compliance with the requisition, the Meeting shall take place notwithstanding, on eight days notice being given in the public papers. The motion was ably supported by the proposer, but opposed also with very considerable ability by a member, with whose name we are unacquainted; and on being put to the vote, was only carried by a narrow majority.*

The Thanks of the Society were then voted to Professor MILLINGTON for his

* An example well worthy of imitation by every other learned Society in the kingdom.

* When noticing, in a late Number, the laws of the Aberdeen Institution, we quoted one to a similar effect as "well worthy of imitation." We are glad to see that our London Mechanics are not above profiting by a good example. The law is a sound and wholesome one; and when it comes again under discussion (for it must be passed twice before it can come into operation), we hope to see the opinions of the Society more united upon it.—*Edit.*

Honorary Course of Lectures (now concluded); to the Vice-Presidents and Committee of Managers, and acknowledged by Mr. M'William, V. P.; and also to the Auditors, for whom Mr. Ellis returned thanks.

A Member then moved that the Thanks of the Society should be given to Henry Brougham, Esq. M. P., and the other benefactors of the Institution for their exertions in its behalf. The motion having been carried by acclamation,

Mr. Brougham rose. He said he felt highly gratified by the thanks of the Meeting, but never were thanks less deserved. He had received a great deal of pleasure from attending the meetings of the Society, which he had done as often as possible, and been both delighted and instructed.

A like vote of Thanks was, on the motion of Mr. Stacey, late Honorary Secretary to the Society, passed to Messrs. Robertson and Hodgskin, for their exertions in originating and establishing the Society.

Mr. Robertson briefly acknowledged the honour which the Meeting had conferred on him and his esteemed coadjutor.

The Thanks of the Society were then voted by acclamation to Dr. Birkbeck, the President.

Dr. Birkbeck acknowledged that it was with no ordinary pleasure that he received such a testimony of approbation from a body of men whose interests and welfare he had always so much at heart. He commended in strong terms the propriety of conduct which they had uniformly displayed at their meetings, and congratulated them on the near prospect of complete success which promised to crown their endeavours.

NEWCASTLE-UPON-TYNE INSTITUTION.

To the Editors of the Mechanic's Magazine.

Newcastle, May 22, 1824.

Gentlemen;—I have great pleasure in inclosing a copy of the rules of the L. S. and M. I., and to assure you our success is complete. Mr. Lambton, in his usual, decided, princely manner, on the instant an application was made to him to patronize the Institution, gave his consent, with a donation of *Fifty Pounds*.

Our officers, generally speaking, are gentlemen of considerable talent and influence.*

I am, Gentlemen,

Your obedient servant,

W. Cail, *Secretary.*

BALLOONING.

We gave in our last a suggestion by a correspondent, S. M., for the construction of a "Balloon Governor;" but have since been reminded, by another correspondent (Mr. T. Bell), that he communicated "precisely the same idea" to us some months ago. On looking over our file of reserved papers, we find that Mr. Bell states but the truth. His letter bears the post-mark of the "6th Jan. 1824;" and, as we now recollect, it was then laid aside as an article *out of season* at that period of the year, but *not undeserving of attention*. In justice, therefore, to Mr. Bell, we now insert that part of his communication which relates to this subject:—

"As regards the construction of balloons, I apprehend there is room for considerable improvement: the first idea that presents itself to my mind on this subject, is the compressibility of gas. Thus, as much gas as will, in an unconfined state, inflate a balloon, is capable of being compressed into a globe of comparatively small dimensions; therefore I would suggest whether, instead of taking up a quantity of ballast, it would not be preferable to be furnished with a strong vessel (communicating with the balloon), into which the gas might be compressed, or removed from its confinement, at the pleasure of the

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* *President.*
C. W. Bigge, Esq.
Vice-Presidents.
The Rev. W. Turner.
T. H. Bigge, Esq.
William Losh, Esq.
John Buddle, Esq.
Anthony Clapham, Esq.
James Potts, Esq.
Benjamin Thompson, Esq.
Secretaries.
Mr. William Cail.
Rev. W. B. Smith, A. M.
Treasurer.
Mr. William Holmes, *Grocer*
Committee.
Messrs. George Stevenson, *Engineer.*
John Dobson, *Architect.*
&c. &c.

aëronaut; for, if he wanted to ascend, he has only to open the communication, and suffer the compressed gas to ascend into the balloon, and *vice versâ*. It is evident, that by this means, the aërial traveller may, with the greatest facility, so regulate the principle of buoyancy, as to either ascend, descend, or remain stationary at pleasure. But this is not the only advantage that would be obtained to the professed aëronaut; for who does not see that the self-same gas may serve for a number of ascents? Instead of letting all the gas escape at the end of the voyage, according to the present method, it might be all compressed into the strong vessel already mentioned, there to be kept in 'durance vile,' till its owner once more wanted its assistance to enable him to traverse the "fields of Æolus." One word farther, with respect to aërial navigation, or the directing the flight of a balloon to any point of the compass at pleasure. It appears to me, that if an apparatus similar to that said to be invented by a Mr. Degan, of Vienna, and described in the first Number of the Mechanic's Mag, page 11, were attached to the car, the wings might then be used to good effect, because the weight of the aëronaut and his machinery would be counteracted by the buoyancy of the balloon, and consequently the whole power of the wings might be directed to the progressive motion, like the flight of a bird.

Your humble servant,

T. Bell.

It is a curious fact, and but a matter of justice to a third correspondent, to mention, that while our last number, containing S. M.'s proposal for a Balloon Governor, was at press, and *before* its publication, we received from Mr. H. C. Jennings, a third proposal to the same effect, adding one more instance to the many on record of different ingenious men, without any inter-communication with each other, hitting on plans and inventions precisely similar.

We perceive, from the American papers, that a native of the United States has invented something that has probably some distant analogy to this Steam Governor, which he calls "A Capillary Steam Engine for navigating the air." We are told, however, that on attempting to ascend with a machine of this sort, at Lexington, in Kentucky, greatly to the disappointment of the wondering citizens, and to the inventor's own mortification, it "obstinately refused to give up its hold of the earth." The projector is, nevertheless, confident that he will yet so improve his machine, as to "soar as high as the eagle."

Before dismissing for the present this subject of aërostation, we cannot help expressing our regret that it should of late years have been so neglected by men of science, and resigned into the hands of a set of ignorant adventurers, who do nothing whatever by their frequent ascents towards advancing the art; but seem, on the contrary, on every occasion, to have no other object in view than to get up a spectacle which may make the multitude stare, and put money in their own pockets. Sir George Cayley, the late Mr. Richard Lovell Edgeworth, and some other gentlemen, endeavoured, about ten years ago, to promote a subscription for prosecuting aërostation on a large scale, and on scientific principles; but it would seem that they had not been able to stir up a corresponding enthusiasm on the subject, since nothing came of their efforts.

The taste for philosophical experiment and discovery, however, is greater now than it was then; and we are not without hopes that such an association may yet be formed. It seems to us discreditable to the spirit of the age, that the matter should rest where it does; it may turn out, that to navigate a balloon as easily as we can navigate a ship is *impossible*; but this we make free to say, that as yet too little has been done in the way of *scientific* experiment to warrant any such conclusion. Many things which seemed at first view quite as unpracticable, have been effected by a persevering application of science and skill; and not till philosophers have *done their best* to obtain a result of practical utility from aërostation, would we have the project abandoned as hopeless.

ANSWERS TO INQUIRIES.

No. 16.—DEPOSIT IN STEAM-BOILERS.

[We have already given several answers to this inquiry; but there is some new information in the following, which it would be wrong to withhold.—EDIT.]

GENT.;—The inconvenience experienced by H. B., from a deposit of calcareous matter on the bottom and sides of boilers, is an evil which will no doubt be greater where much lime is held in solution; but there are few waters to be found which will not occasion it more or less. It happens in the tea-kettle as well as the steam-boiler, and the careful housewife will sometimes endeavour to lessen the evil, by putting in an oyster-shell, which acts merely by attracting part of the matter, which would otherwise deposit itself on the bottom and sides. As the adoption of this remedy in a large boiler would be inconvenient, and is, besides, very ineffectual, it would be, perhaps, a preferable mode to free the water to be boiled from lime before passing it into the boiler. This might be done by the addition of oxalate of ammonia in sufficient quantity, and permitting it time to settle before use. The deposit of which H. B. complains, will be found to consist principally of carbonate of lime, and is formed by the boiling and agitation of the water causing the lime (which the water generally holds pure in solution) to unite with the carbonic acid found in the atmosphere, and thus form a precipitate. Oxalic acid forms with the lime a totally insoluble compound, and the ammonia being liberated, will fly off. But should the lime held in solution be combined with sulphuric acid, as is sometimes found to be the case, the ammonia will unite with it, and, forming a neutral salt, will not injure the boiler, which it might otherwise do.

The weight of oxalate of ammonia requisite to precipitate any quantity of water, may be found as follows:---Take a cylindrical glass vessel, containing at least 2 ozs. of distilled water, and graduated into ten equal parts; dissolve in this, 5 grains of the oxalate; take a pint of the water to be tried in a glass vessel, and drop into it, from time to time, from the solution of oxalate of ammonia, till no more milkiness is seen upon addition of the solution; then observe what quantity of the solution has been useful, and calculate at the rate of half a grain of the oxalate to a pint of the water to be freed for every division consumed.

The oxalate of ammonia may be easily prepared, by dropping carbonate of ammonia into a solution of oxalic acid, till effervescence ceases, and then evaporating to dryness.   F. D.

WEEK'S BRAKE FOR BARKING WILLOWS.

The above drawing represents my new invented brake for taking the bark off willows. The object of it is to prevent their being split, as they too often are, in the stripping, on account of the squeezing with the hand. *The hand is not to be applied at all in using these brakes,* springs being substituted, which do the work besides a great deal more expeditiously.   J. WEEKS, Sen.

Basket Maker, Bristol.

Explanation of the Drawing.

A A is the frame, made of half-inch round iron, about two inches apart, or closer. B B, brake irons to loosen the rind, 11 inches long; C C, screws to adjust the brake irons, according to the size of the rods to be stripped. The wider they are apart on the top, the stiffer they will work at bottom; D D, springs, fixed on with screws at E E; F, a bar or guide projecting an inch to prevent the rod from running down, which, when in use, must be the farthest part of the machine from the operator; and down on it the rod must come when worked; G, a key to keep the brake in its place when erected for use, by passing the end through two staples on a strong stake, provided for the purpose; H to I, fifteen inches; H to K, twenty-one inches, the whole length.

The operator is to place himself in a position so as to have a sway of the body, with the left hand on the rod, to bring it down on the guide, by which the brake will be kept clean from the rind, &c. without further trouble. The chief point in making these brakes is, to make sure of the strength and elasticity of the springs.

METHOD TO PREVENT SHIPS SINKING.

There is a method of making it almost impossible to sink ships, which was known to the ancients, and is now employed by the Chinese. The hold is divided into a number of compartments; so that if the ship spring a leak, or should her sides be stove in in several places at once, those compartments only which are adjoining to the leaks, will fill with water, and the vessel will keep afloat. This method is susceptible of many improvements; and seems particularly applicable to ships of war, the extent of whose stores and manner of stowage are known before-hand, and are not subject to be shifted about like the cargoes of merchant vessels.

TESTS OF BRASS.

This alloy ought to be entirely free from a defect very common to it, of not being well united in the fusion; it should yield readily and easily to the file, and be susceptible of being drilled without cracking or breaking into small pieces. It should also be fit for soldering, and in certain cases (such, for example, as in the making of wind instruments) it should stretch when beaten with a hammer without cracking.

METALLIC CLOTHS.

At the late exhibition of the products of national industry at the Louvre in Paris, there was exhibited a waistcoat, and several other articles made of metal-wire, which are said, in the report of the jury appointed to judge of their merits, to have been "equal to cambric in fineness."

NEW PATENTS.

To George Vaughan, of Sheffield, gentleman; for his improvement or improvements on steam-engines, by which means power will be gained, and expense saved.—May 1, 1824—6 months.

To John Crosby, of Cottage-lane, City Road, Middlesex, gentleman; for his improvement in the construction of lamps or lanterns, for the better protection of the light against the effects of wind or motion.—May 5, 1824—6 months.

To William Cleland, of Leadenhall-street, London, gentleman; for his improvement in the process of manufacturing sugar from cane juice, and in refining of sugar and other substances.—May 6, 1824—6 months.

To John Theodore Paul, of Geneva, but now residing at Charing Cross, Westminster, mechanist; who, in consequence of a communication made to him by a certain foreigner residing abroad, is in possession of certain improvements in the method or methods of generating steam, and in the application of it to various useful purposes.—May 13, 1824—6 months.

TO CORRESPONDENTS.

Several favours designed for insertion in this Number, are unavoidably deferred for want of room. A couple of pages shall be devoted in our next to a numerous list of inquiries.

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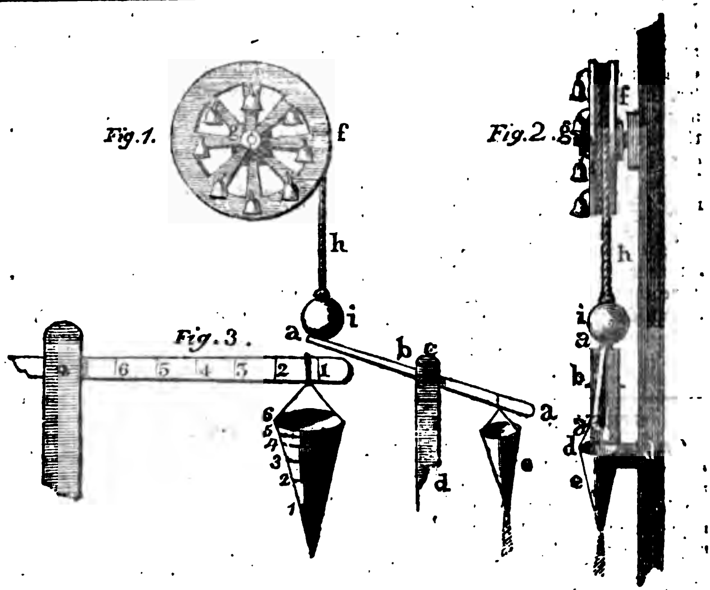
If a man perform that which hath not been attempted before, or attempted and given over, or hath been achieved, but not with so good circumstance, he shall purchase more honour than by affecting a matter of greater difficulty, or virtue, wherein he is but a follower.—*Bacon.*

No. 43.] SATURDAY, JUNE 19, 1824. Price 3*d*.



AUDIBLE SAND GLASS.

Chatham, April 3, 1824.

GENTLEMEN;—I beg leave to send you a plan and description of an ingenious invention, which attracted my notice a few months since. It is designed for an alarum, and appeared to me at once so useful and simple, as to deserve a place in your Magazine. Fig. 1 represents the machine in elevation; fig. 2, in a side view: *a a* is a lever, of which *b* is the fulcrum; *c d*, an upright, supporting the lever; *e*, a glass, or metal inverted cone, open at the base and vertex, and suspended to the lever by three cords; *f*, a circular wheel; *g*, the axle, and *h*, a cord passing round the wheel, to which is suspended a weight *i*, resting on the extremity of the lever. Now, the whole of this apparatus must be compactly fixed against the wall of a room; after which, a number of small bells adapted to the purpose, must be attached to the wheel, as shown in the figure. The whole must be so placed, that when the inverted cone is filled with a sufficient quantity of sand to run for the requisite number of hours, the weight shall be balanced at the end of the lever, and remain so until the whole of the sand being run out, the end of the lever on which the weight rests, becomes the heavier, and lowers; the weight being then no longer supported, is put in motion, and, communicating to the wheel, causes the bells to ring for a considerable time.

It may, perhaps, be urged as an objection to this useful piece of mechanism, that there would be considerable difficulty in setting it properly; but by attending to the following method, it may be entirely obviated. By repeated experiments, observe the several heights to which the sand necessary for every hour, rises in the cone, and mark them as shown in fig. 3. Make similar observations as to the part of the lever to which the cone should be suspended for every hour, and mark them accordingly; by these means the machine may be adjusted in a few minutes, by only pouring in sand to the height marked for the required number of hours, and placing the cone on that part of the lever corresponding to the time required.

I am, &c.

W. H——s.

STEAM NAVIGATION.

Gentlemen;—A correspondent, signing himself A. B., has addressed to me a *private letter* on the subject of the Steam-Navigation query of E. S. C., with a request that any further observations I may have to make, may be conveyed through your Magazine. As he has not given me his address, I am prevented applying to him in any other manner; but as I cannot think your publication a proper channel for answers to *private* communications, I must beg, that either his letters in future may be transmitted to me through the same channel, publicly, or else that he will give me an opportunity of replying to them privately, which a knowledge of his address would enable me to do. With regard to the question proposed by E. S. C. (p. 381, Vol. I), I have stated, that supposing a vessel, sailing with a wind at a given rate in smooth water, should suddenly fall into a tide, she would go no faster, in consequence of the effect of the tide, provided the velocity with which the wind alone would carry her, were greater than the velocity of the tide, excepting that the still water would resist her passage through it, rather more than the water in motion. Before I notice the remarks of A. B., I will make one or two observations in illustration of this.

Suppose a body to be moving at any given rate, and a fresh moving power be applied, whose velocity is greater than its own, the velocity of such body will be increased. But, if a moving power be applied, whose velocity is less than the velocity of the body, it will have no effect at all on it. Thus, if I attempt to push forward a carriage, which is already going faster than myself, it is evident that the carriage would receive no assistance from me, but would run from me, and leave me behind. So, also, if a vessel be impelled by steam, at the rate of four miles an hour, and she come into a fair wind, travelling with a less velocity than herself, the wind will not assist it at all, excepting only that the resistance of the atmosphere will not be quite so much felt as if it were motionless (which would be the case, if there were no wind); but if the wind alone would impel her with a greater velocity than the steam alone, the case is rather altered, provided the velocity of the steam-paddles could be increased *ad libitum* (and I believe they can be so increased). If the paddles travelled with an invariable velocity, the case would be otherwise. A. B. states, that this is an opinion he has always thought correct; but, that practical sailors invariably assert the contrary, and he proceeds to suggest, that the best method of trying the experiment would be with a steam-boat, whose rate of going in still water might be easily ascertained; he then recommends her being taken into the run of a tide, whose velocity was known, to see whether she would go so much faster or no, and afterwards by trying her against the tide, he imagines we might arrive at a just conclusion. This method might, perhaps, satisfy us as to the effect of the joint influences of *steam and tide*, but not as to the joint influences of STEAM *and wind*, since there is a wide difference between these two cases. We may, I think, safely admit, that steam and tide jointly, would impel a vessel at a greater rate than either the *wind and tide*, or *wind and steam*; for the *wind and tide*, when applied together, act on the vessel, independently of each other; that is, the wind does not act on the vessel through the medium of the tide, nor does the tide act on the vessel through the medium of the wind: in short, they both have separate and distinct duties to perform, and are perfectly unconnected with each other. The same may be said with regard to the wind and steam: but the case is very different with the *tide and steam*, since the action of either of these on the vessel, is not independent of the other; so that, in calculating the rate of going under the joint influences *of these two impelling powers*, we must first consider their direct effect on the vessel, and then their effect on each other; or, in other words, we have first the effect of the steam on the vessel, then the effect of the tide on the vessel, and then the effect of the tide on the paddles. With a view of making this more clear, suppose, after having ascertained the exact power which a tide at a certain rate is capable of exerting on a vessel, we place this vessel in still water, and apply an impelling force exactly equal to the power exerted by the before-mentioned tide; if we now set the paddles to work, we have merely the effect of the tide (or a power equal to it) on the vessel, and the effect of the paddles (or steam) on the vessel; for the paddles themselves, *working in still water*, can receive no assistance from the tide. We will now suppose the vessel to be taken out of still water, and after having re-placed it in the tide, that it has attained as great a velocity as the current can give it; if, then, the paddles are set to work again, at the same rate at which they worked *out of the tide*, the velocity of the vessel will be greater than when in still water. I mention this, merely to show that experiments made on vessels, impelled by *steam and tide*, can prove very little or nothing with regard to the effects of *wind and tide;* since, if we substitute the wind for the tide in the above experiment, the same results will not obtain. Mr. Gibbons says (p. 279, Vol. I) that, according to the laws for the composition and resolution of forces, the motion of a vessel in a stream of water, running two miles an hour, assisted by steam, which would of itself, in still water, impel it at the rate of eight miles an hour, would be 8 + 2, or 10 miles with the tide, and 8 — 2, or 6 miles against it. He then adds, that the difference on the Thames *is not so great*, and suggests, that *it may be owing to the stagnation which is caused.* According to the above theory, if a vessel be moving with a certain velocity in a tide, any additional velocity given by steam, would be exactly equal to the whole velocity which the steam would be capable of communicating to the vessel in smooth water. *If the velocity of a floating body were equal to the velocity of the stream on which it floated*, then this effect might obtain, though I cannot say that it *would; that, however, is not the case.* I am quite aware that there is a difference of opinion on this point; and it is held by many, that the velocities of a stream and a body floating on it must be equal. In a previous letter I have ventured to state, "*that if a vessel be impelled by a tide, the tide itself will travel faster.*" This passage has not escaped the notice of A. B., who refers me to an article in Rees' Encyclopædia, under the head of Current: it is there said to be "*self-evident* that any floating body proceeds along a current precisely with the velocity of that current; and that it is also *evident*, that if assisted by a wind, it proceeds at a rate compounded of the velocities of the two forces." Now, this *cannot* be. The velocity of any body, *whose gravity is exactly the same as that of water*, will be equal to the velocity of the stream in which it may be placed; but *if the body be lighter or heavier than the water, its velocity will vary accordingly.* Suppose, for instance, in a stream travelling four miles an hour, I place a floating body, whose upper surface contains twelve superficial feet; this body will immediately displace a quantity of water equal to itself in weight, but not in bulk; and if we suppose the body to be as light again as water, only one-half of it will sink beneath the surface, and the other half will remain above the surface of the water. Now, the water displaced, occupied the space of twelve feet on the surface; and consequently the atmospheric resistance, on the water, before it was displaced, was only felt on this twelve feet. But now, I have not only the upper surface of the body exposed, but one-half of the whole body; and of course that part of it which is above water and in front, will be resisted very sensibly by the atmosphere. The velocity of this body, then, will be equal to the velocity of the current, minus the difference between the atmospheric resistance on a flat surface of twelve feet, and its resistance on the irregular exposed surface of the body, which will be much greater than twelve feet; and although this difference may appear trifling, yet in a vessel, whose bulk above water is very considerable, the effect must also be considerable. If a body be heavier than water, it is clear that it will not travel with the stream, because its own gravity will make it sink. It seems to me, then, that a floating body impelled by a stream with a velocity equal to such stream, must be exactly as heavy as, and no heavier than, the water; and if so, the assertion in my former letter is correct, viz. "*that if a vessel be impelled by a tide, the tide itself will travel faster.*" With regard to the resistance of the atmosphere on the exposed surface of a floating body, its effect may be clearly seen, by placing a piece of cork in a gentle current of water, running against a strong breeze, when the cork, instead of travelling with the same velocity as the stream, will be driven against it by the force of the wind. Thus, also, a boat will often sail against a rapid tide; from which I conclude that the heaviest floating bodies (that is, those which are heavier in proportion to their bulk) will receive a greater velocity from the current in which they may be placed, than the lighter, because they present a less surface to the action of the atmosphere. This may be made even more apparent, by placing a square block of oak or other hard wood, and another square block of cork, of the same weight, into a stream. Each will, of course, displace an equal weight of water with themselves; and as their own weights are equal, each will displace the same number of cubic inches of water, and therefore present an equal surface to the action of the tide; but as the oak will be nearly immersed, it will be but little resisted by the atmosphere; the cork, however, will have by far its greatest part above water, and this will be so considerably resisted by the atmosphere, that its velocity will be much less than that of the oak. *If bodies travelled at an equal rate with the current which impelled them, this difference could not exist.*

In reply to E. S. C., if a wind at eight knots an hour impel a vessel with a velocity equal to six knots, and she were, at the same time, to be impelled by her steam-engine, with a power equal to what would be necessary to carry her with the velocity of six knots through still water, the rate of going of the vessel would be, I think, eight knots an hour, for the reasons stated in my former letter: *it certainly could not be more.*

I am, Gentlemen, yours, &c. &c.

HENRY DEACON.

Portsmouth.

ECONOMY OF HIGH-PRESSURE STEAM.

(Abstracted from Mr. Perkins' Pamphlet).

The received opinion among a large portion of the scientific, as well as practical world, has hitherto been, that there is no economy in using high steam, excepting that of reducing the weight of the machinery and quantity of water used; and no one, it is believed, except Evans, and a few of his disciples, have supposed that there was any other gain. It has been said (and with great plausibility), that the increased power of high steam *is obtained at the expense of velocity,* as is the case in mechanics; that the little advantage gained in contracting and simplifying the engine is much more than counterbalanced by the increased danger. Mr. P.'s object is to show, that the *danger decreases as the power and velocity increases.*

The practical facts already stated prove, beyond contradiction, the safety of using high steam, if the engine is properly constructed, and that a great saving of fuel is made by its use. But it will be more difficult to give a satisfactory reason for the last-mentioned fact than the first; as there is every reason to believe that the knowledge of steam is quite in its infancy, and as no experiment, to any extent, has been made to show the comparative ratio between the expenditure of fuel and the expansive force of steam, Mr. P. may be pardoned, if, in attempting to start a theory, he has failed in making it out. At any rate, Mr. P. is right as to the fact, which no theory can set aside. It is admitted, that while the increments of temperature increase arithmetically, the expansive increases geometrically. But no experiments, to Mr. P.'s knowledge, have been made to show the ratio of the fuel consumed to the expansive force, excepting those made by Mr. Philip Taylor, which are extremely satisfactory so far as they go; but they have not yet been published, and have taken place since Mr. P.'s new engine was commenced.

From the observations Mr. P. has made in the course of his attempts to improve the steam-engine, he believes that something like the following will be the result they will tend to establish, viz. That while the temperature rises in an arithmetical ratio, the expansive force increases geometrically, and that the increments of fuel are in a decreasing ratio.

If it is said that, this being the fact, a much greater gain should have evinced itself than has been the case, Mr. P. answers, that the boilers of high-pressure engines have hitherto been very imperfect. The same kind of riveting which would be perfectly tight in a low-pressure boiler, would allow the escape, almost unobserved, of a large portion of the steam in a boiler under high-pressure. The same with the piston; for a piston that would not allow low-steam to pass, would by no means prevent high-steam from escaping, and so with every part of the engine. The piston of a high-pressure engine, although it has many advantages over the low, yet it has one striking disadvantage, which cannot be wholly got over, even by a perfectly tight one, which is, that the difference of the areas of the pistons in condensing and concentrating engines, is as forty to one, making the joint between the piston and cylinder six times and a half greater in proportion to its contents in the high than in the low pressure. But those who admit a gain in working high-pressure, give the whole credit to working expansively. There is undoubtedly much gain in working expansively.

Suppose a steam-engine cylinder be divided into five equal parts (each part being a cubic inch), one to be occupied by the piston, and the other four by steam. Let the first division contain steam at a pressure of 800 lbs. per inch; let the steam be then cut off by a valve, and allowed to expand so as to fill the next two divisions; the pressure will then be 400 lbs. on the piston, and the mean will be 600 lbs. on the inch; let the steam expand still farther, so as to fill the remaining two divisions: it would then exert a pressure, when at its lowest point, of 200 lbs. on the inch, and the mean will be 300 lbs per inch, equal to 400 lbs. per inch upon the whole, or upon each division. If this cubic inch of steam had been allowed to expand to atmospheric pressure, it would have filled fifty-seven cubic inches, and six pounds per inch (after deducting for imperfect vacuum, working air-pump, &c. &c.) will be its utmost power; while one cubic inch, at 800 lbs. pressure, expanding into four cubic inches, will produce 1,700 lbs. pressure, when, deducting 30 lbs. for the loss of one atmosphere and friction, it will leave 1,670 lbs. for the cubic inch expanded into four. Now, fifty-seven cubic inches, as used by the low-pressure, gives but 342 lbs., little more than one-fifth. If it should be found that it takes as much fuel (which Mr. P. does not admit) to produce one cubic inch of steam, at 800 lbs. to the inch, as it does to make fifty-seven cubic inches at atmospheric pressure, the advantage will still be enormous. Another great gain by using high-pressure engines is as follows: low-pressure engines lose nearly half their power by the imperfect vacuum, working the air-pump, the friction, and working the water-pump, while the high-pressure loses only one atmosphere, friction and working the water-pump amounting to half an atmosphere more. The higher the steam, the greater the economy; for when working with four atmospheres and a half, or 63 lbs. per inch, one-third the power is lost; but when with forty-five atmospheres, only one-thirtieth of the power is expended.

MR. PERKINS' STEAM-ENGINE.

GENTLEMEN;—On perusing the additional statements with which you have favoured us of Mr. Perkins' experiments on steam, I am more and more astonished at the singular coincidence between his plans and mine.* Mr. P.'s re-

* The ingenious writer of this communication had, on the first appearance of any account of Mr. Perkins' new engine in this Magazine, written to us in these terms. His letter is dated, Oct. 6, 1823:—"I feel deeply interested in Mr. Perkins' experiments, having been travelling nearly in the same tract as Mr. P., and with the same

sults appear to have been derived from a series of practical experiments; but the plans I had formed were drawn entirely from a long and severe study of the theory of the subject. The coincidence between them is so singular, that it may be difficult to make any one believe that they did not originate with the same mind, or that mine are not a copy of Mr. P.'s; nevertheless, nothing is more certain than that a great part of my improvements have been arranged for years, and that all, and even the first knowledge I ever obtained, directly or indirectly, of that gentleman's engine, was through the medium of your Magazine. Both plans have precisely the same revolving valve—the same coiled pipe—the same sort of receiver, made of scrap-iron, welded on the principle of the twisted gun-barrel; with two exceptions only, first, as regards the length of the coil, and second, that my receiver is placed on the top of the coil or generator, in a dome, instead of within it, whereby it receives the greatest intensity of heat. The method which I have adopted of supplying the generator with water is superior, I think, to that of Mr. P. His plan of forcing air into the furnace I have never touched upon, and it certainly appears to me, at first sight, an admirable one. The practicability of giving motion to projectiles by steam, was not, however, overlooked; and a mode of doing so had a long time been arranged.

The results, as Mr. P. has given them, so far as they go, are fully equal to my most sanguine expectations; and that gentleman need not be alarmed at any prognostications of his opponents, as to the ultimate event; indeed, I never myself entertained a doubt on the subject.

object in view; yet I had no knowledge whatever of his engine, previous to seeing the account of it in your Magazine. My plan is matured, and I only wait the completion of an engine adapted to it, to prove the effect; but in consequence of not being professionally connected with business of that nature, the work does not proceed so expeditiously as I could wish."

In thus adverting to my own humble efforts, I disclaim all intention of putting forth any pretensions to merit in opposition to Mr. P.; that would be both invidious and unworthy, as he is already before the public, and justly deserves for his ingenuity and exertions every credit and support. It would give me pleasure, on the contrary, could I forward, in any way, his success; and any suggestions that I can offer for that purpose are much at his service.

I am, Gentlemen,
Your very obedient servant,
Wm. Gilman.

LINEAR STANDARD.

Devonshire-street, Portland place,
June 4, 1824.

Gentlemen;—It has often struck me as most absurd, to seek a standard for weights and measures by elaborate, and even fallible experiments upon the length of the pendulum, vibrating seconds in the latitude of London.

However ingenious and adroit the experiments made by Captain Kater may appear to a superficial observer, they are yet far from affording any positive and accurate data by which a true standard of measure can be attained; and the difficulty and expense attending these investigations, preclude a general scrutiny into their accuracy, and present a strong reason against taking them for granted merely.

I would propose a simple way of gaining a linear standard, cheap and easy of accomplishment, as unerring as human wants can possibly require. Let the sun's image, at 12 o'clock, be taken on a white, smooth, reflecting surface, on any one of three or even seven days in the month of August, or in any other month. This standard is invariable: let the sun's diameter be a foot, and its subdivision ten parts, the decimal of a foot, &c. I have such a scale by me, and it is most accurate. It is easy to convert the scale into measures of capacity.

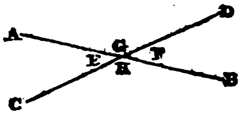
I am, your obedient,
Humble servant,
H. C. Jennings.

MECHANICAL GEOMETRY.

(Continued from p. 454).

THEOREM II.

If two right or straight lines cross each other, the opposite angles are equal.

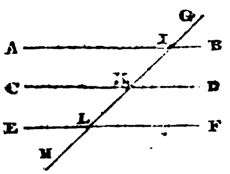


Let A B and C D be two lines crossing each other; we have to show that the angle E is equal to the angle F, and the angle G equal to the angle H. Draw the two lines on a piece of pasteboard or thin wood (veneer), and cut it through from A to B, and from C to D; we shall then have four pieces, which, if we lay upon each other, that is, E upon F, and G upon H, we shall find the bevel of the angle E correspond to F, and that of G to H.

Or, if we lay a rule (as in the first theorem) on the line A B, the joint corresponding to where the lines cross each other, and move one side of the rule (the other being fixed) till it correspond to the other line, the rule will be opened to the angle A G D; if we now place the rule on the other side of the line, it will be found to correspond to the angle B H C; and the like may be shown with regard to the angles at E and F.

THEOREM III.

If a line cross two or more parallel lines, it will make equal angles at each.



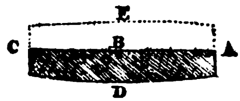
Let A B, C D, and E F, be three parallel lines, and G H another line crossing them, and let them be drawn, as in the last theorem, on a piece of wood or card; now, if we cut out the piece A I C, we shall find it correspond, with regard to the angular point or bevel, to C K I or E L K, by placing A I on C K or E L; and the same may be shown on the other side of the line G H, that is, the piece G I B, when cut out, will correspond at the angle to I K D or K L F, and this may be shown for any number of parallel lines.

Hence, by the help of the last theorem, we may deduce this corollary, viz. That the alternate angles A I K and I K D, are equal to each other; for we have shown, by the second theorem, that the angle A I K is equal to the angle G I B, and by this theorem, that G I B is equal to I K D.

By the help of these theorems we shall be able to exhibit two or three problems of great practical utility to the working mechanic, as follows:—

Problem 1.

To know whether the instrument called, amongst workmen, a *straight edge*, is correct.

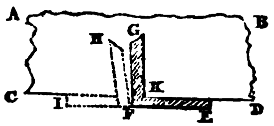


Let A B C D be a piece of wood or metal, one edge of which, as A B C, is to be used to draw straight lines, or by being applied to any surface to try if it is straight, and is, therefore, denominated, amongst workmen, a *straight edge*. Now, to find the edge A B C in a correct right line, draw any line by means of it with a fine tracer or pencil, in which line drive correctly three fine needle points, as at A, B, and C, the one near the centre and the other two near the extremities; then will the straight edge touch all the three points. Now apply it on the other side of the points, as shown at A E C B; then, if it touches all three points in this position, its edge is a correct straight line; but if it touches A and C, without touching that at B, the edge is hollow; on the contrary, if it touches A B, without touching at C, or B C without touching at A, the edge is round.

Or, it may be done without the needle point, by simply applying the edge of the instrument on the other side of the line, as at A E C B; and if the edge then correspond with the line throughout its length, it is correct.

Problem 2.

To prove whether the instrument used by workmen, called a *square*, is correct.



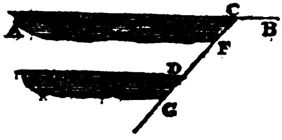
Let A B C D represent any piece of board, and let the edge C D be made perfectly straight, and let the *square* E F G be applied to it; draw a line along the edge of it, as G F, then reverse the instrument, as shown at H F I; then if it corresponds, the whole length, with the line F G, the instrument is correct; but if it correspond at F, and diverge from the line drawn, as shown in the figure, it is not correct.

Now, to make the instrument true, it must be planed towards the stock of the square at F, till, having drawn another line, we find the *square* in both positions correspond with it throughout its length.

It is scarcely necessary to add, that what has been said regarding the outside edge of the *square*, may be applied to the inside edge, as at G K.

Problem 3.

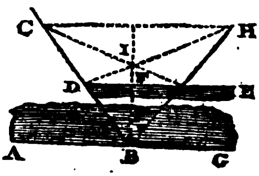
To draw a line parallel to another given line.



Let A B be a given line, to which it is required to draw another line parallel. Take a piece of wood or metal, having the edges A C and C F quite straight, and making any angle at pleasure; apply one side to the given line, as A C to the line A B; then lay a *straight edge* on C F, and draw the line C F D G; then, if we slide the piece of wood along the line C G, suppose in the position E D G, the edge E D will every where be parallel to A, by virtue of the third theorem.

Problem 4.

To draw a line perpendicular to a given line, without the aid of compasses or *square*.



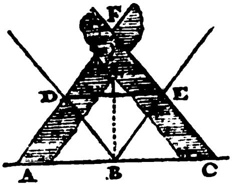
Let A B C be the given line, and B a point from which it is required to draw a perpendicular.

By means of a piece of wood or metal, as in the last problem, draw the lines B G and B H from the point B, and, by the last problem, draw D F E parallel to A B C; then take the half of D E, as at F; make a mark with the pencil or tracer; join F B; then is F B perpendicular or square to the line A B C.

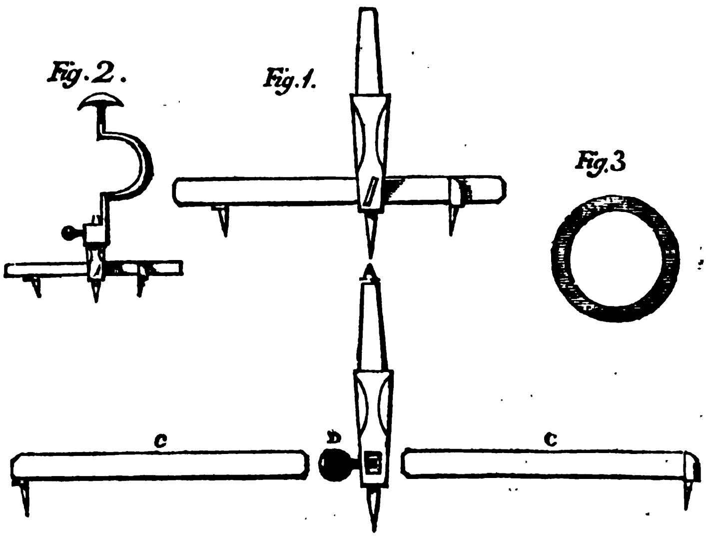
N. B.—In this, as well as in the former problem, instead of the piece of wood with a bevelled angle, a common carpenters' rule may be substituted; for the two sides may be opened to any given angle, as G B A, and the parallel line D F E, be drawn; for, by the corollary to Theorem 3, the angle F D B is equal to the angle D B A.

Or, we may also perform this problem without dividing D E in the point F; for, if we draw a second parallel, as G H, and draw the line G E and H D, the point I where they cross each other will be that point from which, if we draw I B, it will be perpendicular to A B C.

This problem may be also performed another way, as follows:—



Having drawn B D and B E from the point B, and also D E parallel to A B C by the first method, draw now A D F parallel to B E, and through the point D; and also C E F parallel to B D, and through the point E: the point F, where these lines cross or intersect, is the point required. If we join F and B, F B will be perpendicular or square to A B. G. A. S.



UNIVERSAL CUTTING TOOL.

March 17, 1834.

Gentlemen;—Having, in the course of my employment, frequently some hundreds of stout leather-washers, flanges, and other circular pieces, of various diameters, to cut, for equipping gun-carriages, and other purposes connected with the ordnance service, I was led to the invention of an universal tool, of which I now submit a drawing and explanation. A is a piece of iron, in which a hole B is made, to allow the two cutters *c c* to pass through by the side of each other, when they may be fixed, by the set screw D, to any radius from the centre point E, as shown in fig. 1, with the cutters attached. Fig. 2 shows the tool fixed in a common brace or stock, such as I generally use, in order to cut the washer, fig. 3. If a circular piece of leather is required to be cut, without any hole in the centre, it is only necessary to adjust the cutters so as to follow each other.

This instrument cuts the stoutest of leather with the greatest correctness and facility. The leather, however, must be slightly tacked down on a board (a piece of willow or lime-tree I prefer.)

It is with a degree of diffidence that I presume to trouble you with the above; but believing it will be found particularly useful to coach-makers, engine-makers, plumbers, and many other classes of tradesmen, I hope it may be deemed not unworthy of a place in your valuable Magazine.

Your most obedient servant,
A Collar Maker.

N. B.—The tool, as exhibited in the drawing, is about one-half the size of that I am using at present.

[Since the above was in type, we have received a letter from the writer, in which he ingenuously states that he has been informed, since transmitting it, that a tool precisely similar in principle, called the Expanding Centre Bit, is already known to mechanics. As we have no doubt, however, that the present invention was an original one with him, and as it possesses, besides, great merit, we see no occasion for withdrawing the account of it.—Edit.]

STEAM ARTILLERY.

Gentlemen;—Observing in your 41st Number, that Mr. Perkins had found a *new discovery* for the application of steam to the firing of musket-balls, I beg leave to inform you, that *this discovery is quite old*, the same having been practised at the manufactory of Boulton, Watt, & Co. at least twenty-five years ago. Veritas.

[We owe it to the cause of truth to give publicity to the above statement; but we must, at the same time, remark, that though the idea of applying steam to the throwing of projectiles, may not be as new as Mr. P. supposes (it would have been surprising indeed had so obvious an application of it *not* occurred frequently before); yet, while steam was employed on the old *low-pressure* plan, it was an idea which could not be carried with any advantage into practice. Mr. P. has still, therefore, all the merit of having first so developed the powers of this great agent, as to show that it is not only an economical substitute for gunpowder, but a far more potent instrument of destruction.

The expense of this new species of ammunition would be limited almost entirely to the first price of the apparatus; for the fuel requisite to the production of the steam, would cost comparatively little. Of the power gained, some idea may be formed when we state, that while the medium expansive force of gunpowder is only 750 lbs. on the square inch, Mr. P. has increased the expansive force of steam to upwards of 50,000 lbs.!!! —Edit.]

SHOEMAKING MACHINES.

June 1, 1824.

Gentlemen;—I perused with much pleasure, in the 36th Number of your Magazine, an article entitled "Standing Shoemaking Machines;" and as the subject is both a useful and interesting one to that branch of artisans for whose benefit it is intended, I shall take the liberty to make a few observations thereon, trusting that Mr. Johnson (the inventor of that plan, marked fig. 3, and to which I particularly refer) is too fervent a votary to scientific pursuits to take umbrage at any remarks that may be made on his ingenious contrivance for improving the health and aiding the manual exertions of a very useful class of mechanics.

It may be necessary to state, that in that part of the operation of shoemaking called sewing the rand or heel, the shoe is placed bottom upwards, with the heel next the workman, as represented in the engraving, fig. 3, p. 121. Now it is evident, that in sewing the heel, the workman must either partially move round the shoe, or the shoe itself must be made to perform a rotatory motion; the last-mentioned course is pursued when the operator sits to work. As by the standing machine the shoe is fixed, this movement must be made by the mechanic; and you will perceive that he cannot perform it with that ease and celerity which it is desirable he should do, by reason of the impediment produced by the form of the table. This, I think, may be remedied, by making that part of the front of the table whereon the shoe is immediately placed, project or form half the circumference of a circle, which would enable the operator, by varying his position, to reach the back part of the heel with that degree of convenience which he would be unable to perform by the method represented in the engraving. Another remark I would beg leave to make as to the manner in which the cushion is fixed to the table. In sewing on the top pieces (the pieces of leather which form the heel are so called), the shoe is placed on its SIDE, with the heel, as before, nearest the workman; now it is requisite, before half the heel is sewed, that that part of the cushion which is *fixed* by pivots, and marked B in the engraving, should be raised from a *horizontal* to a *perpendicular* position. To perform this motion, I conceive it to be only necessary to *reverse* the manner of attaching the cushion, by fixing the pivots or hinges to the *back* of the cushion where the half-circle of iron is placed, and to place the half circle where the pivots are fixed. Indeed, I know not the advantage to be derived from raising the cushion at the farthest extremity, as represented in the engraving.

What has been said respecting the heel, applies, likewise, in a considerable degree, to sewing and stitching round the toe of the shoe. The clams I conceive to be placed in an awkward situation, and in the way of the workman when sewing the shoe; I should advise their being placed on the RIGHT side of the table, and consider a screw preferable to the button. The spring to the stirrup is a valuable improvement. OISELEUR.

A FEW DOUBTS RESPECTING A NOTABLE THEORY.

Limehouse.

GENTLEMEN;—I cannot comprehend how it is that a man can be said to sustain a pressure of 30,240 lbs. of the air above him. All writers on pneumatics, however, that have come within the narrow limits of my reading, concur in stating this as a *positive* fact, and qualify the proposition, by adding, that "the air pressing equally on all sides, within the body as well as without, no sensation of pressure can be excited;" so that the thing is considered *true, in fact,* although we are not sensible of it.

Allow me, Gentlemen, to state the simple process of ratiocination by which my mind has been brought to an opposite conclusion.

In the first place, the air within the vesicles of the body, I imagine, possesses the same properties as the external air; consequently gravitation must have as much influence on the former as it has on the latter; it must, therefore, be preposterous to suppose that the external air presses downwards, and the internal upwards, to resist it.

Secondly, by supposing the "air to press EQUALLY on all sides," or as much laterally as it does perpendicularly, upwards as downwards, we contemplate a pressure that must be caused by the electricity of the air, and which cannot be affected by gravitation, and consequently the whole 30,240 lbs. must fall to the ground at once, because the data on which it rests is, by such an hypothesis, entirely removed; for who would think of calculating the vertical pressure of the atmosphere by its height, under an impression, that *whatever may be our situation in it, we are as much pressed by it from beneath as we are from above.*

But if the external air *does* press downwards to the extent in question, it must necessarily be admitted, that the internal air must have an equivalent pressure upwards; so that if a man could by any means be relieved of the column of air above him, he would be pressed upwards to the same extent of pressure. Prodigious! What prevents our poor aëronauts from having their brains bumped out against the lower part of their balloon?—Yours, &c.

MINIMUS.

BALLOONING.

GENTLEMEN;—The *condenser* and *hoop* suggested by your correspondent, I conceive to be most ingenious contrivances. The condenser, however, in the hands of an *ignorant* aëronaut would be attended with great danger, and I would propose, as an improvement, that a tube, reaching from the car, should be firmly fixed into the balloon, and that at the lower end a mercurial gauge should be attached, which would indicate the pressure of the elastic vapour within the balloon beyond any chance of doubt or misconception.

I am glad to see you offer your opinion on ballooning in the manner you have done. The words "*ignorant adventurers*" may give offence and displeasure to some of our *celebrated* aërial voyagers; but the following passage in one of their *reports*, which I read lately in most of the newspapers, fully warrants the appellation:—"The inclination of the balloon to *ascend* was *extremely strong*, *owing to the rarefaction of the atmosphere.*" *The rarefaction of the atmosphere!* Again—"After we had been in the air, we could not hear each other speak, *owing* to the *density*;" or, in other words, *sound is stronger in a vacuum* than in condensed air!!! Now, this is downright nonsense, as any person acquainted with the doctrine of specific gravities and pneumatics (and I may add phonics) must instantly perceive. The person who could make such a statement, must be perfectly ignorant of some of the simplest principles of aërology.

In order to render ballooning subservient to the purposes of science, the aëronaut ought to have with him (instead of "mere baggage"), besides the ordinary appendages, an electrometer, an expert draughtsman, and a number of vials full of water, which should be emptied at different altitudes, or perhaps, at certain indications of the electrometer, and instantly corked air-tight, in order that the air may afterwards be subjected to a chemical examination.

J. Y.

CASTING MEDALLIONS.

In No. 28 of your valuable work, I observed a method of casting medallions, which method I put in practice, but find it impossible to bring the lead and antimony in a state of amalgamation. If an "Old Caster" will be more explicit on that head, he will confer a lasting obligation on

AN OLD MECHANIC.

Wisbeach, March 17, 1824.

AFRICAN OAK.

A correspondent requests us to warn those who, in the course of their business, have occasion to work upon African oak, of the poisonous effects of splinters of it when run into the flesh.

He states, that two sawyers in his neighbourhood have died from it, and that several others have been laid up.

A chemical analysis of the wood would put an end to all doubts on the subject, and would, perhaps, save some valuable lives. We hope to see it immediately undertaken.

HINT TO THERMOMETER MAKERS.

Professor Griscom, of New York, in one of his recent lectures on chemistry, when adverting to the circumstance of the thermometer being frequently deranged, through the separation of the column of quicksilver, pointed out the following simple remedy:—Tie a string to that end of the scale opposite to the bulb, and then whirl it round the head with rapidity. The effect he ascribes to the centrifugal force produced by the rotatory motion.

THE PROBLEM THAT ONE IS EQUAL TO TWO.

GENTLEMEN;—As none of your correspondents have noticed the paper which appeared in your Magazine, p. 181, Vol. II, signed "A Mechanic," the following observations may be of service:—

I wish to be distinctly understood, that I do not either defend or refute the assertion, that "one is equal to two" (*i. e.* the whole is equal to its part); those who labour to explode such errors as this, seem to resemble the knights errant of old, whose business it was to destroy giants and dragons which never existed.

If *a*, *b*, *c*, *d*, are to be considered as part of a series in geometrical progression, the ratio must be the divisor in decreasing, and the multiplier in increasing; and every term must be a multiple of that ratio; therefore, since neither 0 nor infinity can be produced by division or multiplication, neither of those terms can belong to the finite series *a, b, c, d;* for it is clearly finite, since $b \times c$ is given as the geometrical means, which quantity the series can never exceed. Let *a, b, c, d* = 2, 4, 8, 16; the greatest extent this series will admit is 1, 2, 4, 16, 32, because 1 is not divisable by the ratio 2; and if the 32 be multiplied by 2, without dividing the other external quantity by 2, 4×8 is no longer the geometrical mean. Perhaps the principal of these proportions may appear more clear by considering the properties of a simple arithmetical series.

Arithmetical progression is the addition of equal quantities to each term, as 4, 6, 8, 10, where it is evident that $6 + 8$ is equal to $4 + 10$; because all the differences being equal, the 4 must be as much less than the 6 as the 10 is greater than the 8; and if the number of terms is odd, as 2, 4, 6, it is evident that $2 = 4 - 2$, and $6 = 4 + 2$; hence $4 + 4 = 2 + 6$, because the $+2$ and -2 cancel each other.—I remain, Gentlemen,

Yours, &c.

R. B.

MR. BENNET'S IMPROVEMENT IN PUMP-IRONS.

Tuesday, June 8, 1824.

GENTLEMEN;—Your correspondent, J. Bennet, of Lincoln, should not have claimed as his invention the improvement in pump-irons, which he takes so much pains to describe in p. 200, Vol. II, of your Journal: the wheel and irons, in fact every thing as there described, have been attached to the pumps of the water-works at London-bridge for the last forty years, and the thing is common in most parts of the country where pumps of a large size are used. There are several plans by far superior to that, which I shall take the liberty of sending to you as soon as I can spare a little time to make a sketch of them.

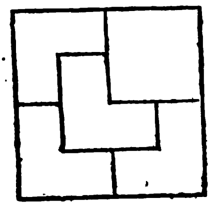
I remain yours, &c.

X. Y., *a Millwright.*

ANSWERS TO INQUIRIES.

No. 5.—QUODLIBET'S PROBLEM.

No less than twenty-six solutions of this problem have been received, and they are all alike, except one, which happens to be erroneous. The diagram which we subjoin, will show at once, without the aid of any explanation, how the respondents agree in showing that three-fourths of any given square may be divided into four equal parts, "each of the same shape and size." Our intelligent correspondent, J. Y., remarks, that it is a pity the words "same shape and size" were used; for similar figures are of the same shape, and may, or may not, contain the same area. Had the querist substituted the words "consisting of similar figures of equal area," many other beautiful demonstrations of the Problem might have been given. But why may not our readers consider the question as proposed to them of new in this shape?



DEPOSIT IN STEAM-BOILERS.

(Another Answer).

To the Editors of the Mechanic's Magazine.

Strand, May 2, 1824.

GENTLEMEN;—In answer to the inquiry of your correspondent H. B., in No. 34 of your useful publication, respecting the deposit on the bottoms of the boilers of steam-engines, I beg to inform him, that it is the practice of several respectable manufacturers in this neighbourhood, who employ both high and low-pressure engines, to put into the boiler, when it is cleaned out, about half a bushel of potatoes, which, after some boiling, deposit a slimy settlement upon the bottom, and thereby prevent the strong adhesion of the calculous deposit occasioned by evaporation. When the boiler wants cleaning, the deposit or sediment will come off in large flakes, and with little difficulty.

I am, Gentlemen,

Your obedient servant,

A WELL-WISHER.

INQUIRIES.

[While making the present large addition to our List of Inquiries (and many still remain for insertion), we beg to direct the attention of our numerous readers and correspondents to the number of inquiries to which no answer has yet been given.—We shall be obliged, shortly, to take upon ourselves the task of answering some of them, and would have done so ere now, were it not the great object of this department of our work to stimulate others to make public the fruits of their experience, and to induce the better informed of our mechanics to exercise their pens in instructing their less enlightened brethren,—one of the best ways, besides, of improving themselves.—*Edit.*]

Nº 19. The best method of finishing or striking cropsole leather, with a description of the machine recommended for that purpose? *W. K.*

20. The best mode of dying worsted of a scarlet colour, with the lac powder; as also of preparing the spirits in which it is used? *A Constant Reader.*

21. Which is the most desirable, cast or milled lead, for laying gutters and flats on the tops of buildings? Opinion is much divided on the point; and if, through the medium of the Mechanics' Magazine, a collection of experimental facts could be obtained, shewing the comparative results where both have been laid with equal precaution, the dispute might be set at rest, and an essential benefit be rendered to the public. *J. S.*

22. The best varnish for oil-paintings, painted wooden boxes, fire-skreens, &c. and how prepared? *A. B.*

23. Why do the threads of a left-hand tap *appear* more spiral than those of a right-hand one, and *vice versâ*; though in fact the angles of each are precisely the same—a fact well known to smiths and engineers? *Tyro.*

24. What form is best for a chimney at the opening above the fire, by workmen called the throat? Should the size of the flew be regulated by the size of the room? And if so, what size would be requisite for a room containing an area of 36 square feet, and another containing 600 square feet?—The answers to these queries, if satisfactory, will be of great use to practical builders, and of vast importance as regards our domestic comfort. *One who enjoys his friend most when the smoke rises freely up the chimney.*

25. The best composition for a ground, and also the best liquid for etching upon polished-steel or iron? *Etcher.*

26. The best sort of steel for making iron, brass, and wood-cutting tools? *A Mechanist.*

27. An easy method of drawing the solids and conic sections in Bonnycastle's Mensuration, from the dimensions therein given? one of a sort will be sufficient. *A Constant Subscriber.*

28. When a finely-ground colour, diluted with gall water, is lightly laid on the surface of a solution of gum tragacanth, what will effect a smoothness of the same, without causing expansion or contraction? *E. L. Y.*

29. The method of imitating Morocco leather on paper, especially the different shades of red; the materials used, and manner of using them? *P. M. N.*

30. Which requires least manual labour in the case of a common ship-pump, a long or a short spear? *A Ship Pump-Maker.*

31. The best method of silvering clock-dials?

32. The ingredients necessary to compose a good bronze, and the best method of applying it? *A Constant Reader.*

33. The manner of tinning cooking utensils, that is, cast-iron boilers, saucepans, stew-pans, &c. after the tin is worn off? *A Brazier.*

34. The process of drawing lead-pipe from half an inch to two and an half inches in bore? *A Plumber.*

35. How can the ivory of the keys of piano-fortes be preserved from fading, and how restored to its natural colour, after having turned yellow? *A Subscriber.*

36. Having a veneer of beautiful wood, which forms a complete circle, and having an order for two oval tables which must be veneered with this wood, and made as large as possible, I wish to know if I can cut this veneer in such a manner that I shall be able to complete my order without wasting any more of the veneer than is caused by the dividing of it with a saw, and making the joints good? *G. A. S.*

37. Take a pack of playing cards, and make three heaps, containing fifteen in each (reckoning from the number of

pips on the first card); deduct from the remnant, and the number of cards in hand will be equal to the sum of all the pips on the three bottom cards.

Example.

Suppose the first card a six; turn it down, and add nine cards, making altogether fifteen for the first heap; draw another card, a ten;* turn it down as before, and add five more cards for the second heap. Lastly, draw a third card, say a *one*, and proceed as before: there will now be twenty-one cards in hand, from which, if four are taken away, you will have $17 = 6 + 10 + 1$, the numbers of the pips on the bottom cards.

Query.—Why should four be deducted? and what analogy (if any) is there between the numbers in each heap, and fifty-two, the number of cards, or three hundred and forty, the number of pips in a pack? *E. W. S.*

* A picture-card is considered as a ten.

SAFETY MAIL-BAG.

Colonel Laporte, a French gentleman, resident in Virginia, has invented a safety mail-bag, which is highly spoken of in the American journals. It is thus described in the New York Daily Advertiser:—

"It is proposed to substitute for the leathern bags now in use, a net-work, composed of iron rings, inclosed between two covers of deer-skin stuffed with wool, and covered outside with strong leather. A bag formed in this manner, would resist the force of almost any power which, in ordinary circumstances, could be applied to it. It is proposed to fasten the mouth with a newly-invented and very secure lock, and to attach the whole to the body of the mail-carriage, so that none but the post-master shall be able to open or remove it. The weight of the new bags, which seemed at first an objection to them, need not exceed much more than double that of those now in use, and in the new invented promises much greater durability than the old bags."

ADULTERATED HOLLANDS.

Smuggled Hollands have been often known to be largely impregnated with sugar of lead, for the purpose of depriving the spirit of the colour which it always acquires from being kept for some time in the tubs in which it is brought over sea by the smugglers, the clearest Hollands being popularly considered the best, and always bringing the highest price. A few years ago this species of adulteration was carried to such an extent in a certain town on the Essex coast, that it produced among the inhabitants a general malady, of which numbers, young and old, died. The distemper was at length discovered to be no other than what is commonly known by the name of the *painters' cholic*, and the secret cause of it to be the sugar of lead with which the smuggled Hollands in common use in the town were impregnated. The principal delinquent in this nefarious imposition was a chief officer of excise, who had been in the practice, in order to increase the King's revenue and his own, of resorting to this device to raise the price of all the condemned spirits sold under his direction. Since his detection we believe it has been made a rule by the Board of Excise that none but coloured Hollands (which all smuggled Hollands in their genuine state are) shall be exposed to sale at their warehouses. In as far, of course, as regards smuggled Hollands bought at Excise sales, purchasers may consider themselves safe; but with respect to the far greater proportion which are successfully run into the market, the temptation to enhance the price of them remaining the same, and it being still the vulgar notion that the clearest Hollands are the best, buyers cannot be too much on their guard against imposition.

The danger to which persons expose themselves from the use of spirits thus adulterated is infinitely greater than is generally imagined. Among the persons who suffered from its effects in the town before alluded to, was a dissenting clergyman, whose only offence (if offence it can be called) against temperance, was the habit of drinking a single glass of Hollands and water after supper; yet, small as was the quantity in which he unsuspectingly indulged, such was the virulence of the secret poison it contained, that it proved ultimately the cause of his death.

The test for this poison is very simple. Drop into a small quantity of the suspected liquor a single drop of a solution of sulphate of soda, or sulphate of potash. If the liquor assumes a dark, turbid colour, it is a certain proof that it contains metallic poison.

The use of sugar of lead for the purpose of lessening the colour of Hollands is the more reprehensible, since the same object may be equally well effected without the slightest injurious consequence by other means. Put, for instance, a quantity of bone charcoal into the spirits; shake the mixture from time to time, and in two or three days the colour will disappear completely.

DAMASCUS BLADES.

It is well known that the steel of Damascus is found in a natural state, and is prepared by the Orientals in a manner peculiar to themselves. This kind of steel is distinguished from all others by its hardness, by its resistance to the file, and by its mottled surface, consisting of fine veins of an ash grey colour, whence it is termed *damasked*. M. Breant, after a long series of experiments, has discovered that it is a cast steel, only charged more highly with carbon than European steel, and in which, by the effect of cooling, well managed, a sort of crystallization is effected, or rather a separation of the two distinct combinations of iron and carbon. The same experimentalist is said to have discovered a simple and cheap means of directly converting cast and bar irons into steel. The details of the process, however, are not given.

NEW PATENTS.

To John Potter, of Smedley, near Manchester, spinner and manufacturer, for certain improvements in looms to be impelled by mechanical power for weaving various kinds of figured fabrics, whether of silk, cotton, flax, wool, or other materials, or mixtures of the same; part of which improvements are applicable to hand-looms.—May 13—6 months.

To Jacob Perkins, of Fleet-street, London, engineer, for his improved method of throwing shells and other projectiles. —15th May—6 months.

To William Church, of Birmingham, esq. for certain improvements in the apparatus used in casting iron and other metals.—15th May—6 months.

To John Holt Ibbetson, of Smith-street, Chelsea, esq. for certain improvements in the production of manufacture of gas.—15th May—6 months.

To Lemuel Wellman Wright, of Well-close-square, Middlesex, engineer, for certain combinations and improvements in machinery for making pins.—15th May—2 months.

To William Henry James, of Coburgh-place, Winson-green, near Birmingham, engineer, for his improved method of constructing steam-carriages useful in the conveyance of persons and goods upon highways and turnpike-roads without the assistance of rail-roads.—15th May—6 months.

TO CORRESPONDENTS.

"North Star's" description of an improved Fruit Gatherer, shall have a place before there is fruit to gather. The other paper he mentions, never reached us. His last communications are valuable, and are appropriated for insertion.

G. A. S. deserves our best thanks.

X x is certainly deceived in the supposition that the pressure of the steam would be in a diagonal direction. Elastic fluids, in giving motion to a body, must act *between* such body and another body at rest, fixed at right angles to the line of motion. This would not be the case, however, in regard to the body against which X x's proposed wheel would act; for its surface in contact, and the direct line of motion being precisely parallel, no motion could be generated by steam acting between them.

A Correspondent would be obliged to Teulon to acquaint him with the expense of erecting such an Oil Gas Apparatus as that he has described in No. 40. Another friend would be glad to know where such an apparatus can be seen.

W. S. may rest assured, that no reward has ever been offered. Let him read the different papers which have appeared in this Magazine on the subject, and he will discover why there has not.

Communications received from A Well-wisher—R. B.—G. Gladwell—Protector — Josias Murray — Eebliw — Mico — A Well-wisher — Aurum — E. Jameson — R*I*N.—T. M. B.—W. T.—B. C.—A Rope-maker—But a Clown—A Reader —Mechanicus—Pry—A Constant Reader —Tyro—W. E.—T. G.—E. Q.—J. T. B. —R. J.—C. C——n. — G. Lovett — I. H——b——n. — Amateur Mechanic— T. S. — On Smokey Chimneys (without signature).

Communications (post paid) to be addressed to the Editors, at

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Museum, Register, Journal, & Gazette.

There is no time or place, no transactions, occurrences, or engagements in life, which exclude us from improving our minds by observation.—*Watts.*

No. 44.] SATURDAY, JUNE 26, 1824. [Price 3d.

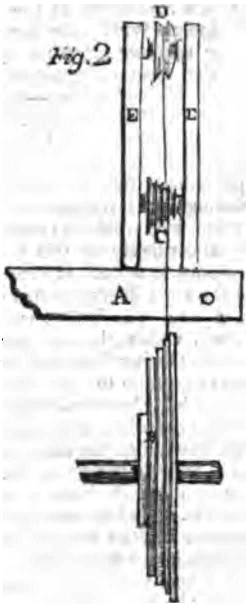

Fig. 2

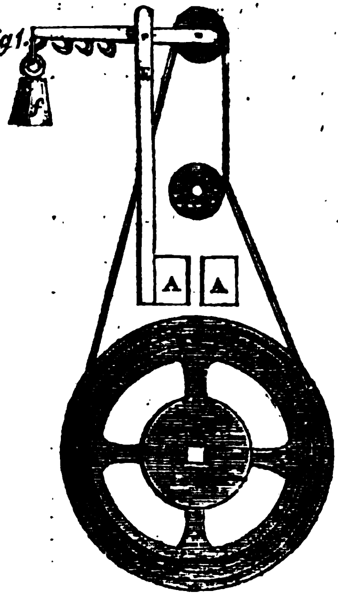

Fig. 1

IMPROVEMENT ON THE LATHE.

London, April 18, 1824.

Gentlemen;—I was much pleased on observing in your valuable publication C. Williamson's plan of an addition to the common lathe, not only because I consider it calculated to diminish the labour, but that it is from such suggestions as these that much good may be expected to result to practical mechanics, through the medium of your Magazine. When those who have been hitherto in the habit of using their hands only, begin to use their heads also, who can tell the benefits that may arise, not only to themselves, but to mankind generally? C. W.'s improvement, though extremely valuable, seems to me, however, susceptible of considerable simplification. I have, therefore, taken the liberty of sending you a rough drawing of a plan which, it appears to me, will effectually prevent the line from chafing, and likewise obviate the necessity of changing the line for heavy work, as in the plan of your correspondent, in No. 32.

Figure 1 is the appearance of the lathe endwise; C represents one of two pieces, which are fixed to the back-bed of the lathe; F is a lever, moveable on the center *o*, which r has a piece cut out of the end, to admit the extra pulley D, which must, to allow the band to pass without rubbing, be placed so as to stand in winding with the pulley on the mandrel, as shown by *d*, fig. 2; the lever F is furnished with hooks, on which the weight G is hung, according to the nature of the work. It would improve the plan if the grooves in the mandrel-pulley, instead of being angular, were turned rather flat at the bottom.

Fig. 2 will be readily understood, as the same letters denote the same parts as in fig. 1.

A A are beds of he lathe; C, the mandrel-pulley; B, the large wheel.

OMEGA.

MONUMENT TO THE LATE JAMES WATT.

Not many weeks have elapsed since, in reading the last published volume of M. Charles Dupin's Travels in Great Britain (one of the best-informed and most liberal works on this country ever produced by a foreign pen), we felt most deeply the national reproach conveyed in the passage, of which the following is a feeble translation:—

"To a citizen of Glasgow belongs the glory of having given to industry one of the greatest impulses known in the history of the arts. To the improvements invented by the celebrated Watt it is owing that the steam-engine is become an universal moving power. No invention ever before comprehended, within so small a compass, and at a fourth of the ordinary expence, a power so great, so constant, so regular. In Watt we behold one of the *benefactors* of his country. Yet when I earnestly inquire what brilliant testimony he has received of the national gratitude, my question remains unanswered. It appears that neither king nor ministers nor parliament have yet discovered that they owe any thing to the life and memory of one to whom the ancients would have erected statues and altars. The ashes of the player Garrick repose under the sacred vaults of Westminster, while the ashes of WATT moulder in the obscure nook of some obscure cemetery."*

The forcible appeal to the national feeling contained in these lines has not been made in vain, nor suffered to remain long unanswered. Almost immediately after, M. Dupin has had the satisfaction of seeing† the king's first minister and representative presiding, and *commissioned* by his royal master to preside at a Public Meeting for erecting a Monument to the Memory of James Watt. He has seen this prime minister attended by several of the most enlightened and eteemed of his colleagues,—by Mr. Robinson, Mr. Peel, and Mr. Huskisson,—and has heard that only national business of still greater moment prevented the attendance of other distinguished members of administration, who would have assisted with equal cordiality in this solemn act of commemoration. He has seen some of the most illustrious members of the senate — a Wilberforce, a Mackintosh, a Brougham—individuals, too, who at other times are usually beheld in opposition to the officers of the state,—joining heart and hand with them on this occasion, to proclaim to the world how much the nation owes of wealth and of power to the improver, and all but the inventor of the steam-engine. He has seen (a sight unfortunately but too rare) all party spirit and feeling extinguished for the moment, that a great act of national justice might be done with one accord. He has seen, moreover, the head of the most scientific body in the country,—and who has been placed at its head because he owns no superior in the field of science,—coming forward to give, as it were, the sanction of science to the popular opinion, which places James Watt foremost on the list of those who have conferred benefits on their country and on mankind.

The Meeting presented altogether one of the noblest and most gratifying

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* M. Dupin has paid a still more circumstantial tribute to the merits of our illustrious countryman in a discourse entitled "*Considerations sur quelques Avantages de l'Industrie et des Machines en France et en Angleterre,*" delivered at the general sitting of the four Academies of the French Institute, 24th April, 1821.

† M. Dupin was present at the Meeting.

spectacles which it has ever been or may ever again be our lot to behold. It was remarked truly by Mr. Brougham, that a monument was not wanting to immortalize the name of Watt, for that name would live as long as the power existed which he had subdued to the use of man: but that it was wanting in order to consecrate his great example in the eyes of all mankind, in order to show to others, in every station of life, the honours that await those who, like James Watt, employ their genius and talents for the public good. With the same design, we now devote the better part of our present Number to giving an account of the proceedings at this interesting meeting. We are convinced that we shall be doing an acceptable service to our numerous readers among the working classes, by letting them see how justly the merits of humble industry were appreciated, and how frankly acknowledged by almost every one who spoke on the occasion, and particularly by Mr. Secretary Peel, who did himself more real honour by his manly acknowledgment of what he owes to cotton-spinning, than if he had boasted "all the blood of all the Howards." The handsome notice which was taken of the London Mechanic's Institution will also be read with peculiar pleasure by a large portion of our readers.

The Earl of LIVERPOOL having been unanimously called to the Chair, proceeded to address the Meeting—

LADIES AND GENTLEMEN;

We are here assembled to-day for the purpose of paying a public tribute of respect and gratitude to the memory of one of the most excellent and most extraordinary men to whom this country has given birth [loud applause.] In such an assembly as this, composed as it is of men, many of whom were acquainted with Mr Watt, and are by far more capable both of appreciating and describing his merits than I can pretend to be; it would be presumptuous in me to enter at length into the very excellent invention of which he was the author. The application of the mighty power of the steam-engine has been compared to the trunk of an elephant; and so far with justice, for as there was nothing so small, so there was nothing so great as to be beyond its reach [applause]. It has improved the finest of our manufactures, and at the same time half the difficulties which stood in the way of navigation have vanished before it [loud applause]. We have now no delay in our communications with other and distant countries;—be the winds of Heaven favourable or contrary, still we can calculate upon a fixed and certain intercourse [applause]. I remember a time when the fate of armies frequently depended on the rapidity with which communications were made; that difficulty is no longer to be feared, as we can have the most rapid communication by a proper application of the power of steam. I will not detain you by expatiating the transcendant merits of this invention, but I must say a few words with respect to the inventor. I feel much pride and pleasure in stating, that I had the honour of being acquainted with Mr. Watt. That he is to be ranked amongst the benefactors of mankind cannot be denied, because there are none who deserve more of their country than those who add to the productive powers of industry. It must be observed, too, that Mr. Watt's invention was not the result of accident, but the consequence of long, and steady, and laborious application of scientific knowledge, aided by great genius [applause.] With respect to the private character of Mr. Watt, there never was a more amiable, a more honourable, or a more excellent man [applause]; and if he did not in his life-time meet with the patronage and consideration due to his great talents, it was owing solely to his simplicity of character, the modesty of his nature, the absence of every thing like presumption or ostentation, and that disinclination to obtrude himself, not only on the great and powerful, but even upon the scientific world, of which he was himself so great, so bright an ornament [loud applause]. I repeat, that I feel much satisfaction in being able, from my own personal knowledge, to say so much; and that pleasure is increased by the reflection, that while the world enjoys the benefits derived from his great talents, this country, which has had the honour of giving him birth, is the greatest and most permanent participator in those benefits [applause]. This country possesses more wealth and greater resources than any other; and with respect to the power of steam, possessing, as we do, a greater supply of fuel than any other country, we must always command advantages from the application of steam which no other country can enjoy [applause]. When, therefore, I hear it stated that different effects will be produced in the event of our being engaged in war, I feel satisfied of this, that whatever may be the temporary advantages derived to other countries by the adoption of this great power, the permanent advantages resulting from it must rest with this country [Hear, hear!]. I have only to add, that I am commanded by his Majesty to state, that he feels deeply sensible of the merits conferred on this country by the individual to whose memory we are now about to pay a tribute of respect and gratitude [loud applause]; and that his Majesty is most anxious to place his royal name at the head of the proposed subscription for the sum of 500*l*. [loud cheers].

Sir HUMPHRY DAVY: I ought to apologise for rising so immediately to address this Meeting. But as the distinguished person whose memory we have met together to honour, owes his claims to the gratitude of society, to his scientific labours, and as he was one of the most illustrious Fellows of that Institution for the promotion of natural knowledge over which I have the honour to preside, I consider it as a duty incumbent on me to endeavour to set forth his peculiar and exalted merits, which live in the recollection of his contemporaries, and will transmit his name with immortal glory to posterity. Those who consider James Watt only as a great practical mechanic, form a very erroneous idea of his character; he was equally distinguished as a natural philosopher and a chemist; and his inventions demonstrate his profound knowledge of those sciences, and that peculiar characteristic of genius, the union of them for practical application [applause]. The steam-engine, before his time, was a rude machine, the result of simple experiments on the compression of the atmosphere, and the condensation of steam. Mr. Watt's improvements were not produced by accidental circumstances, or by a single ingenious thought; they were founded on a sense of delicate and refined experiments. He was obliged to bring all the mechanical powers, and all the resources of his own fertile mind into play; he had to convert rectilineal into rotatory motion, and to invert parallel motion. After years of intense labour, he obtained what he wished for, and at last placed the machine entirely under the power of the mechanic, and gave perfection to a series of combinations unrivalled for the genius and sagacity displayed in their invention, and for the *new power* they have given to civilized man. Upon the nature of this power I can hardly venture to speak; so extensive and magnificent a subject demands a more experienced and able orator. What is written on the monument of another illustrious and kindred Philosopher will apply to Watt—

"Monumentum si quæris, circumspice!"

Look round the Metropolis, our Cities and our Towns—our Dock-yards and our Manufactories;—examine the cavities below the surface, and the works above; contemplate our rivers and our canals, and the seas which surround our shores, and every where will be found records of the eternal benefits conferred on us by this great man. Our mines are drained and their product manufactured—the materials for our bridges are raised—and the piles for their foundation sunk by the same power. Machinery of every kind, which formerly required an immensity of human labour, is now easily moved by steam; and force, equal to that of five hundred men, is commanded by an infant, whose single hand governs the grandest operations. The most laborious works, such as sawing of stones and wood, and raising of water, are effected by the same engine, which produces the most minute, ornamental, and elegant forms. The anchor is forged—the die is struck—the metal polished—the toy modelled by this stupendous and universally applicable power; and the same giant arms twist the cable rope, the protector of the largest ship of the line, and spin gossamer threads, which are to ornament female beauty. The winds can no longer be considered as superior to our power, for steam has insured the progress of our vessels, even against adverse gales, and has almost conquered for us a new element. The Archimedes of the ancient world, by his mechanical inventions, arrested the course of the Romans, and stayed for a time the downfall of his country. How much more has our modern Archimedes done? He has permanently elevated the strength and wealth of this great Empire, and during the last long war, his inventions and their applications were amongst the chief means which enabled Britain to display power and resources so infinitely above what might have been expected from the numerical strength of her population. Archimedes valued principally abstract science. James Watt, on the contrary, brought every principle to some practical use; and, as it were, made science descend from Heaven to earth [applause]. The great invention of the Syracusean died with him; those of our philosopher live, and their utility and importance are daily more felt—they are among the grand results which place civilized above savage man—which secure the triumph of intellect, and exalt genius and moral force over mere brutal strength, courage, and numbers [applause]. The memory of James Watt will live as long as civilized society exists; but it surely becomes us, who have been improved by his labours—who have wondered at his talents, and respected his virtues, to offer some signal testimony of our admiration of this great man. This, indeed, cannot exalt his glory, but it may teach those who come after us that we were not deficient in gratitude to so great and signal a benefactor [loud applause]. I, therefore, my Lord, beg leave to move,

"That the late James Watt, by the profound science, and original genius, displayed in his admirable inventions, has, more than any other man of this age, exemplified the practical utility of knowledge, enlarged the power of man over the external world, and both multiplied and diffused the conveniences and enjoyments of human life."

Mr. BOLTON seconded the Resolution in the following address:—"My Lord, Ladies, and Gentlemen,—I present myself to your notice under the consciousness, that though I shall occupy a small portion of the time of this meeting, I shall need a large share of their indulgence in my endeavours to lay before them a few illustrations of the genius and character of the individual whose merits we are proposing to commemorate. Intimate as has been my friendship and intercourse with Mr. Watt through the whole of his and my life, and great as is my veneration of his unrivalled talents and merits, I am aware these considerations alone would not authorise me in asking any portion of the attention of the assembly I am now addressing; I am induced to hope for it solely under the idea that my intimate acquaintance with the progressive introduction of his great invention, and the application of it to our manufactures, may enable me to offer some observations connected with your view of the effects of Mr. Watt's invention not falling within the scope of the remarks of the distinguished President of the Royal Society. The philosophy and science of Mr. Watt's great and happy conception would always have placed him in the first rank of the philosophers of his day; and his merits in embodying the principles of his invention in the most perfect practical form, so as to render them most conducive to the extension of the nation's wealth, power, and comforts, are inferior only in the next degree to his eminent scientific attainments

At the period of the construction of the first steam-engine upon his principle, at Soho, the intelligent and judicious Smeaton, who had been invited to satisfy himself of the superior performance of the engine by his own experiments upon it, and had been convinced of its great superiority over Newcomen's, doubted the practicability of getting the different parts executed with the requisite precision, and augured from the extreme difficulty of attaining this desideratum, that this powerful machine, in its improved form, would never be generally introduced. Such was, at that period, the low state of the mechanic arts, as fully to justify his opinion; but a school of workmen in every relevant branch was speedily and successfully instituted, and the forms and construction of the machine were perfected with a skill and accuracy till then unknown in the execution of large machinery. A convenient and efficient instrument was formed; competent to give to every branch of manufacture the fullest development. The cotemporary improvements of an Arkwright, a Wedgewood, and of many other distinguished manufacturers, several of whom are now before me, assembled to do honour to kindred genius and talents, formed upon an economical, regular, and manageable power, ready to give effect to their plans and enterprises. The most effectual adaptation of this machine to the varied operations of our diversified establishments, was a studied and accomplished, and, what is now almost matter of routine, was, for a succession of years, attained by the continued efforts of a deeply reflecting mechanical mind, and by a series of ingenious experiments, and researches throughout the whole scope of British manufacture [Hear, hear, hear!]. In this investigation Mr. Watt had the co-operation of some highly enlightened colleagues, to whose merit and exertions he has paid a just tribute in his report on the steam-engine [applause]. It, however, is but justice to say, that his comprehensive mind embraced with like success the minutest details, and the application of the most abstruse science [applause]. A power equal to that which would require the maintenance of 100,000 horses, has been furnished from the single establishment to which Mr. Watt belonged; and assuming that power to be exercised during 300 days in the course of the year, the saving arising from the substitution of steam-power in lieu of the exertions of the animals themselves, would not be less than two millions five hundred thousand pounds per annum [applause]. Extending this calculation to the whole of the steam-power produced and used throughout the kingdom, we shall be supplied with a clear indication of one of the sources of power and wealth which have supported this nation through its late arduous struggle, and which have accelerated the renovation of its impaired energies with a celerity exciting surprise in every reflecting mind [loud applause]. A corroborative inference will be derived from a comparison of the present and former states of some of the leading branches of our manufacturers. The rapid extension of the cotton-trade has justly been observed by the first authorities to be unparalleled in the commercial annals of any country. Iron, of which we were large importers not many years since, is now extensively exported; and while the cotton products of steam-power are successfully carried to the original site of this manufacture in India, iron, made by the same power, if unshackled by commercial restrictions, might be placed on the quays of Petersburgh in successful competition with that of Siberia [applause]. I am not, therefore, I think, incorrect in concluding, that the fortunate completion and introduction of this useful and powerful instrument, in conjunction with the cotemporary efforts and talents of many of our distinguished manufacturers, encouraged and animated as they are by the enlightened policy of our government [applause], have produced an era in our manufactures and trade, unexampled in any state or age [applause], and one that will confer a conspicuous distinction on this country in the history of empires. I am not, I trust, ascribing an undue share of this prosperity and pre-eminence to the genius and merits of my late friend, Mr. Watt; and though I cannot divest myself of partiality for the memory of an individual with whom I know it was esteemed by my father one of the highest distinctions of his life to have been associated, and the inheritor of this sentiment, if possible, still more deeply impressed, I anxiously hope I should not be deemed to have been improperly influenced by this feeling in seconding the Resolution moved by the learned President of the Royal Society, [loud applause].

The Resolution was then put, and carried unanimously.

Mr. HUSKISSON: My Lord, it has devolved upon me to do that which would have been much better done by any one of those respectable gentlemen who composed the Committee, and who are more intimately acquainted, than I can pretend to be, with the great merits of the excellent man whose memory we are about to commemorate, and who were, I may say, eye-witnesses of the incalculable benefits which he has conferred, not only upon this country, but the whole of the civilized world [applause]. But, however ill-qualified I may be to estimate the merits of Mr. Watt, or to do justice to his exalted merits, I feel that I should be wrong if I remained silent upon an occasion so important as the present. And I feel, that whether we abstract ourselves altogether for a moment from all considerations of country, look solely to the great benefits conferred and still conferring upon civilized man, or look with a more concentrated view upon its influence on our own country, it is impossible to contemplate these benefits and not feel the highest admiration for the transcendant genius by which these benefits were conferred [applause]. It is a gratification to feel that such a man was born in this country; but it is a still greater gratification that we lived in the same age with such a man, and have had an opportunity of enjoying all the benefits and advantages which he, under God, has been the instrument of conferring, for the increase of the happiness of mankind [Hear, hear, hear!]. If any man who now hears me, doubts of Mr. Watt's right to be placed in the first class of men of genius, and of practical utility combined, I say that that man has not properly considered the subject; that he has not properly reflected upon the influence of his chemical and mechanical science, on the moral condition of society [applause]. No man, I apprehend, can doubt what that influence has been, not only here, but all over the civilized world; for there is no country so remote, no portion of the globe so little open to our commerce, that they do not enjoy some portion of the benefits of Mr. Watt's invention [Hear, hear!]. The great benefit conferred by that gentleman consists in the abridgment of labour, the perfection and rapidity with which our manufactures are executed—the almost indefinite production of every article, to suit the wants, and wishes, and convenience of the people. And, be it observed, that by this you also improve the moral condition of mankind; for by creating new wants in the minds even of savage nations, you infuse new ideas, and a spirit of exertion, which will stimulate them to industry, and an improvement of their condition. If I were called upon to illustrate this opinion, I would refer to those remote countries in the Pacific, in one of the islands of which our celebrated and intrepid navigator, Capt. Cook, lost his life. We now find, that in those islands a state of civilization exists, and that they have made greater progress than still remains to be made, in order to elevate them to the rank and character of Independent States [applause]. If the former savage of those islands has exchanged his nakedness or his rags for the linens and cloths of England—if the articles of his household furniture and of his industry be changed in the same way, I say that it is mainly owing to the facility which the steam-engine affords of manufacturing these articles at a cheap rate, and with such great celerity [applause]. We all know the great physical and productive power of the steam-engine, but it is not, perhaps, so generally known that it has acted as a great moral lever to raise a degraded, and before uncivilized people, to a sense of civilization and independence. It is a power which has extended its beneficial influence over the moral condition of all [Hear, hear, hear!]. If such be the effects of this invention abroad, how much greater have been the benefits conferred by it here? I shall not detain the Meeting by entering into a detail of the increased wealth, happiness, and general prosperity which it has produced in this country; but if I were to enter into such a detail, I should only prove that amongst the great causes to which these benefits were to be ascribed, the mechanical and chemical improvements which have been made in our time hold the first rank [applause]. I feel it unnecessary to go at present into that question; but I cannot help stating, that on looking back to the contest in which we were for the last quarter of a century engaged, it is not too much to say, that we are mainly indebted to the new resources furnished us by Mr. Watt, for the manner in which we brought that contest to a conclusion [loud applause]. I say, my Lord, that but for those important mechanical and scientific improvements, making as they did a gradual, silent, but certain accession to the wealth and industry of the country, we might have been obliged to sue for a humiliating peace before all the energies of Nelson were called forth at the Battle of Trafalgar, or before the military sway of the Continent was broken down by the Duke of Wellington, and the seal set to the peace of Europe by the victory of Waterloo [cheers]. Great, my Lord, as are the benefits which we have derived from this power, we may anticipate still greater benefits from its future efforts; and, perhaps it may, by persons yet unborn, be applied to purposes not at present thought of. It is from all these considerations that I beg leave to move,

"That these benefits conferred by Mr. Watt on the whole civilized world have been first and most experienced by his own country, which owes a tribute of national gratitude to a man who has thus honoured her by his genius, and promoted her well-being by his discoveries."

Sir J. MACKINTOSH: My lord, ladies and gentlemen;—I am now to perform that part of the duty allotted to me upon this question. I offer myself to your lordship's notice, not because I have any thing new to add, but because I feel that it would be disrespectful to remain silent, and decline the high honour conferred upon me [Hear, hear!]. The late Mr. Watt has a double claim to our gratitude. If he were only a discoverer, still his name would stand in the first rank of philosophers; if the light which led him on was not the result merely of accident, as were the discoveries of many who had gone before him, still his life would form an epoch in the present age [applause]. But such is not the case; in him we find art and science combined—genius and mechanical knowledge, going hand in hand, and both directed to the best practical uses for the benefit of society. Mr. Watt directed the whole energy of his great powers to the improvement of a hitherto neglected machine. That machine he has, by his exertions, so improved, as to make it the most beneficial instrument ever given to society, and by which the greatest benefit can be conferred on mankind [applause]. The debt of science has been paid by the President of the Royal Society, than whom no man is better qualified to bear testimony of the merits of the late Mr. Watt, or more capable of describing the benefits which he has conferred upon society. It has been well described to you that the inventions of Mr. Watt have been mainly conducive to the preservation of the State, as well by the increased resources which he furnished, as by the spirit and genius which he awakened. You have been told, and with great truth, that this novel power, this great discovery, while it has spread riches amongst one class of society, has had the effect of giving to the poor those enjoyments which were heretofore considered the luxuries of the rich. Thus has the country been armed with new means of arming and protecting itself; but the benefits arising from Mr. Watt's discoveries do not stop here: for we find that by extending our traffic to foreign countries, we inspire even savages with new desires, we awaken new faculties, which act as stimulants in the march of civilization. I may here, instead of using my own language, be permitted to refer to that of one of the greatest philosophers ever produced by this country—I mean my Lord Bacon, who in a work, I believe but little read, his *New Atlantis*, describes a voyage to an imaginary country, in which he mentions what he calls Solomon's House, and sometimes the College of the Six Days Works. In that House he describes a magnificent gallery for men of science, a part of which is filled with the statues of inventors. The great and unrivalled wisdom of that philosopher did not disdain to place amongst the first rank of science those inventors who benefitted their country by their inventions. In one place was seen the inventor of glass; in another the inventor of the management and use of the silk-worm;—what place, I ask, would my Lord Bacon have given to Mr. Watt, had he lived in his time? [loud applause] He would undoubtedly have placed him at the head of all inventors of all ages. That great philosopher goes on to state, that whereas lawgivers, extirpators of tyrants, fathers of their country, and the like, are honoured as demi-gods, inventors are honoured with the title of gods. You have been told that this was the only invention in the useful arts which is purely the result of science. Cases of accidental discovery we find scattered over the world, and no man can pretend to say after one such improvement, that a series of other improvements must necessarily take place. It is, however, otherwise with inventions and discoveries which are the result of scientific study and inquiry. Every step you there take is a prelude to a further and more certain progress, and from the past you can with certainty calculate the future. When I reflect that but sixty years have elapsed since the introduction of this great power, and that it is a much shorter period since Mr. Watt has applied it to purposes of practical utility; and when I recollect the delightful description given of that power by my honourable friend, the President of the Royal Society, I must confess that my astonishment is greatly excited. Let us look over the globe, and we find its powers every where in motion—in the bowels of the earth, upon the highest mountains, upon the face of the waters. From the Mississippi to the Ganges, the name of Mr. Watt is heard, and the benefits of his invention are felt [applause]. I heard only the other day that all the great rivers of South America were now navigated by steam; so that the savage who inhabits the forests of Guiana becomes alarmed at the appearance of a monster, which makes its way upon the waters, without apparent effort or moral agency [applause]. If so much has been done in so short a time, what may not a sanguine hope whisper to itself, as to the future? For myself, I confess, that in contemplating what has been already done, I entertain trembling hopes, which I should not wish to expose to the eye of the scorner. But I feel that still nobler things are reserved in the unopened volumes of destiny. What we have seen is the surest pledge of what we have a right to expect. The combination of the fine and useful Arts has had the advantage of spreading general knowledge over a greater number of minds, and making it easy even to the working classes of society—a set of men for the most part, of shrewd, intelligent minds, and anxious to obtain information. I visited a short time since, in company with an honourable and learned Friend now near me, an Institution in this metropolis, where lectures are delivered to mechanics. There I saw 800 mechanics attending a lecture, and a more orderly or respectable meeting, or one which from the cleanliness of the men indicated greater moral propriety, I never witnessed. The lecture was upon a subject which was, in appearance, but in appearance only, far beyond their comprehension—it was upon the law of attraction, which the almost super-human mind of a former President of the Royal Society revealed to the world. The lecturer was describing the diminution of the power of attraction in proportion to the squares of the distance; and when he concluded, the whole meeting broke into one unanimous burst of applause, as if they felt that a new and sublime truth had at once been revealed to their understandings [loud applause]. A more intelligent plaudit was never, perhaps, uttered by any assembly.—The honourable and learned Gentleman, after a few additional observations, concluded by giving his cordial support to the Resolution.

The Resolution was put, and carried unanimously.

Mr. BROUGHAM: I cannot but feel, my Lord, the distinguished honour that has been shewn me, in being permitted to take a part in proposing the Resolutions that are adopted for the purpose of embodying the sentiments of this Meeting. I am well aware that I am indebted for this honour, not so much to my own merit as to my being an humble, though zealous, supporter, in conjunction with an honourable friend of mine, of that Institution, the object of which is to bring science within the reach of the humble artizan, and the effect of which is to bring forth such talent as may be obscured in poverty, to follow in the footsteps of him who had once, like those mechanics, been obscure, but whose genius now shone with a brilliant and useful lustre. But there is another ground on which I wish to address you: I had the pleasure of knowing Mr. Watt in his private life, and though in his public capacity his talent and merit were prodigious, yet I may safely call on those who were acquainted with his domestic habits to bear testimony with me to his private worth, and to bear me out, when I declare that nothing could be more pure, more simple, more candid, or more scrupulously loving of justice, than his conduct in every situation. His versatility of accomplishments was so various, his power so great, and his application so universal, that it is hard to say which is most to be admired—the extent of his understanding, or the nicety with which he was able to reduce it to the smallest circumstances. It has been observed of some illustrious man, that he might be compared to an elephant, as there was nothing so large or so small but he was able to grasp, and so of James Watt it might with truth be said, that he resembled one of his own engines, in which we are at a loss to tell which we ought most to admire—the extent of its grandeur, or the delicacy of its touch, so that while, as my honourable friend has just observed, it has power to tear up and cleave rocks, it can with equal ease fashion the head of a pin, or pierce the eye of a needle. Nay, so universal was Mr. Watt's genius, that while it thus expanded to the greatest designs, it could at times descend to embrace the niceties of classical and verbal criticism. Mr. Watt, too, was most eminently distinguished by the total want of jealousy in all his proceedings [cheers]: he was conspicuous for a most careful self-denial in his actions, lest he should appear to be desirous of appropriating to himself the honour that was due to others: it was this that always made him decline, what every body was willing to concede to him, the honour of being called the inventor of the steam-engine, contenting himself with the title of its improver, though to doubt of his right to this honour were as absurd as to doubt the original genius of Sir Isaac Newton, because Descartes in one line and Galileo in another had preceded him [applause]. Mr. Watt always took peculiar delight in adjusting description of a contrivance of mine to enable tailors also to work at their business without sitting. I was prompted to the invention by the desire of obviating the injurious effects which sitting had upon my health. I have used it for three years, and have performed every kind of work with it, standing, with as much facility as I could sitting, and, in fact, more so.

A B is a bench, about 36 inches high; F is a block of wood, 4 inches deep from D to C, 2 feet in breadth from E to G, and 10 inches over from D to H, and may be placed on any part of the edge of the bench. E G are two cushions, 15 inches in circumference, stuffed with hair, or any thing which can be conveniently had, and nailed firmly on the block of wood. G is the cushion, on which the workman holds his work to sew it, the same as he would do on his knee when sitting: the other cushion is principally to rest the sleeve-board on when pressing, though it can be used the same as the other to sew on. This machine is, in fact, an artificial lap; and can be moved to any part of the bench as convenience may require.

When pressing his work, a small stool, or any thing which will raise the workman three or four inches, will be found to be of great service, as he will have a much greater command of his work.

Any number of men may work in this way, by having several of these machines on a bench, and having a number of benches in rows.

I suppose it is scarcely necessary to observe, that the workman may occasionally sit if he choose, though, after two or three days standing, he will find that he will no more need to sit than a carpenter or blacksmith.

I am, Gentlemen,
Your most obedient servant,
J. C. S.

Messrs. PARKES & SON's SMOKE-CONSUMING APPARATUS.

Gentlemen;—I have read, in the 8th Number of your Magazine, the description of Mr. Brunton's apparatus for the consumption of smoke from steam-engines; and as the subject, not long since, occasioned much public discussion, and several schemes have been submitted, with a view not only to the saving of fuel, but also towards diminishing the nuisance occasioned by the smoke from steam-engines, and other manufactories where large boilers are employed, I have made it my business, from interested motives, to learn which of the modern contrivances has proved the most efficacious, and is the easiest of adaption to boilers already in use. I give Mr. Brunton much credit for the ingenuity of his invention; and I believe, that by means of his apparatus, the avowed object, viz. that of destroying the smoke, is very considerably effected. Your correspondent does not state the saving of fuel: I am informed it is about 20 per cent.

In introducing to your notice the smoke-consumer, for which a patent has been obtained by Messrs. Parkes & Sons, of Warwick, I conceive two or three advantages may be pointed out which entitle it to a claim for general adoption, not inferior to any of the plans which have been submitted for accomplishing the end in view.

1. With respect to its simplicity, and consequently the small expense of the consumer.

2. The practicability of its application, not only to steam-engine boilers, but to pans and coppers of all descriptions.

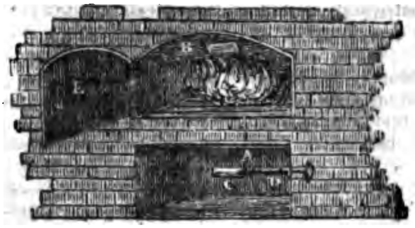
3. The saving of fuel.

4. Its efficacy, as to destroying the smoke.

5. The saving, as relates to the wear of furnace-bars, boiler-bottoms, and brick-work.

A. represents the ash-pit of a fire-place, from which an air-passage communicates at the valve or door C, to the throat of the chimney at B, and is regulated by a small iron rod at D. A current of cold air, which naturally rushes in at C, is always coming in contact with the smoke just as it is entering the chimney, and thus preventing it from ascending, it is thrown back over the flame of the fire, and is there entirely consumed.

In building the fire-place, Mr.



Parkes endeavours, as much as possible, to expose the *whole* of the boiler-bottom to the heat of the fire: by this means the water is made to boil quicker; and a large surface being acted upon by the flame, no particular part is liable to be burnt out sooner than another, as is mostly the case when only a small surface is exposed to the force of the fire. There is a space of twenty or thirty inches between the door E and the furnace-bars, which is kept nearly filled with coals to confine the heat. The coals must be pushed forward three or four times in the course of the day, which duty is nearly all that is required from the attendant, after the fire is once made up. There is, also, a damper in the chimney, which may be partly or entirely shut to confine the heat, according to circumstances.

It will be obvious, from the above drawing, that Mr. Parkes' smoke-consumer can, with the greatest facility, be applied to any furnace now in use, and not being encumbered with any machinery, is not liable to get out of repair. Its extreme simplicity is its great recommendation, and no force being required to keep it in action, gives it a decided advantage over the rotatory fire-place.

The saving of fuel appears to vary according to the draft of the chimney, and other causes, for which I am not able to account. From the information I have obtained, it may be stated, on an average, from 20 to 25 per cent.

As the smoke is prevented by the current of air from rising up the chimney, and is forced back over the flames, it is easy to conceive that its combustion must take place; and a description of this simple contrivance might well satisfy us of the correctness of the theory. I was last summer introduced to the manufactory of Messrs. Bevington, in Bermondsey, where I saw the apparatus attached to four or five boilers, and vessels of different descriptions. My own observations convinced me of its efficacy, and confirmed me in the opinion I had entertained of the advantages which would result from its universal adoption. The smoke was obviously destroyed, and being burnt under the boiler, must render the saving of coals very considerable. The door of the fire-place was so cool, that it could be opened by the hand. There was no roaring or sighing noise, which is usually heard from a furnace; and the bars and brick-work remain in good condition four times as long as on the old construction.

The other argument in favour of smoke-consumers, which should not be overlooked, is the abating of a great nuisance to the neighbouring inhabitants.—Yours, &c.

FUMIFUGUS.

ANOTHER MODE OF CONSUMING SMOKE SUGGESTED.

Manchester, June 1st, 1824.

GENTLEMEN,—Being employed in a respectable provincial concern, where experiments have been tried, to a great extent, for the consumption of smoke, and which have invariably ended more or less in disappointment, a thought has occurred to me that it might not be impracticable to ignite the smoke with carburetted hydrogen, or coal-gas, in some part or other of the boiler-flue. A retort might be set up adjacent to the boiler for this purpose; and whenever the stoker renewed the fuel, he might, by opening a cock, turn in the gas, and continue the emission as long as necessary. This gas would need no purification. I should be happy to have the opinion of any of your chemical correspondents on this subject.

I am, Gentlemen, yours, &c.

R.

P. S.—Some of your readers may say that this is done already, since smoke is coal-gas; true—but then it is so mixed with atmospherical air, &c., and extended so much over the fire, as to deprive it of its combustibility. With the help I propose, however, I have no doubt of its consumption.

PICKERING'S STEAM-BOILER.

To the Editors of the Mechanic's Magazine.

Plaskynaston, June 15, 1824.

Gentlemen;—Amid the various plans for flat high-pressure boilers which suggested themselves when my mind was occupied with the subject, I endeavoured to select the form which appeared to me to combine sufficient strength with the greatest simplicity of construction; but that the humble attempt I have made to attain this end admits of considerable improvement there is little doubt, and it would give me much pleasure to see it brought to perfection.

As mistaken data lead to false conclusions, I fear either myself or your intelligent correspondents who have honoured my boiler with their notice in the 39th Number of your Magazine, entertain erroneous ideas respecting highly heated steam, when subject to great pressure. The little I am able to conceive of the matter is, that when so confined, and exposed to such excessive pressure, the bubbles never become large enough to cause that swelling or ebullition of the water observable in open furnaces, or which may take place in the common steam-boiler. If I am correct in this idea, I think it is evident that the combined mixture of steam-bubbles and water would never swell up so far as to stop the steam-pipe, or be carried into it, without the floating gauge indicating to the engine-tender too great fulness in time to enable him to prevent such effect by shutting off the feed; and as in the boiler I recommend, the room for the steam to escape upwards extends the *whole length* of the different compartments, I conclude that these small bubbles would find no difficulty in making their way to the top without agitating or carrying the water before them in any great degree, should the steam-room of six inches square, extending the whole length of the upper compartment, be deemed insufficient: there is nothing to prevent it being made as large again, provided condensation could be guarded against. My reason for connecting the three compartments, was a wish to secure them from injury in case they should get empty, which, from the very small quantity of water contained in each, I fear, were they separate, would occasionally happen, in spite of every care which might be taken; but according to my plan, the upper ones, which are least exposed to the action of the fire, would get empty first, which the engine-tender would hardly fail to discover before the lower one became exposed to danger from the same cause.

I never saw a common steam-boiler *boil over*, according to the common acceptation of the term, though I have often witnessed their throwing out their water. This takes place through the *feed-pipe*, the lower opening of which being generally inserted considerably below the surface of the water in the boiler, whenever the engine is not at work, or when the safety-valve is too heavy, or when the steam cannot escape through it fast enough; the accumulation of steam acting on the *surface* of the water, forces it out of the boiler in a regular stream, till it is reduced to a level with the bottom or lower opening of the pipe in question, at which moment, but not before, a mixture of steam and water rush out with great force. The process is, I conceive, exactly the same as when a volcano throws out its lava; the confined steam acting on the surface of the melted matter, forces it up the funnel of the crater, which, like the feed-pipe of a common boiler, it is reasonable to suppose has its lower opening at the beginning of the eruption, far beneath the surface of the molten sea, which becoming by degrees lowered to that level, steam, lava, stones, &c. rush out together with thundering explosions, and most terrific grandeur. Terrible earthquakes, and horrible destruction follow; for the immense cavern being thus exhausted of the steam which upheld it, and the greater part of the lava it contained being consequently unable to support the superincumbent earth, it sinks in, forming, by the irregularities of its roof, or bottom, those inequalities on the earth's surface, and all the *faults*, *troubles*, and dislocated strata, so well known to geologists and miners. Whoever has closely observed the process of refining iron, when the metal is poured into the mould, and the slag on its surface begins to cool, must have noticed how well this theory is exemplified by a number of little volcanoes which rise above the surface of the crust, and display all the phenomena here described, in the most perfect manner.

Being too much engaged in business to pursue these disquisitions, it was not my intention to have troubled you again, and I beg to apologize for doing so, hoping to see my place supplied by others much abler to cope with the subject I have humbly endeavoured to bring before the public.

I remain, Gentlemen,
Your obedient servant,
J. Pickering, Jun.

MEASURING ROUND TIMBER.

Gentlemen;—Observing in your Magazine of April 3, 1824, a letter signed Measurage, on what *he* terms the erroneous method of measuring round timber, I respectfully beg to submit the following remarks on timber-measuring.

Being a country mechanic, I have frequently been employed in measuring timber both for the buyer and seller. I am aware that the customary method of measuring what is called round timber, would not be correct, were it used to measure a cylinder; but as timber-trees are not cylinders, it is much nearer so than *Measurage*, and others who have before written on the subject, have asserted. I am certain, from the observations I have made, that if *Measurage's* method were adopted, the buyer would never have as many solid, or cubic feet of timber, as would be measured to him by it; because, by his method, the circumference of every tree would be considered as that of a circle. It is known, that the circle contains more than any other figure of the same circumference; and, consequently, that any (the least) variation in the circumference of a figure from that of a circle, must cause the contents of such figure to be less than that of the circle: and the more the variation, the more will be lost in the contents. Every one knows, too, that trees in general are far from being perfectly round; and this alone proves, that *Measurage*'s method would lead to error, if adopted. His tree, for example, of 40 feet in length and 48 inches in circumference, does not contain 50 feet 11 inches, because it is measured as a cylinder, while it is not perfectly round, as a cylinder is considered to be. A cylinder, one foot in length and four feet in circumference, by customary girt-measure, contains one foot, and the true contents of it, measured as a cylinder, are 12·732 feet. Now, if trees were measured in the same manner, the excess would appear to be more than one-fourth over the customary girt-measure; but, as before observed, their circumference exceeding their contents, more or less than that of a circle, takes off some part of this excess. In addition to this, many trees have hollow parts along their surface, so that in girting them, there is an open space between the line and the outside of the tree: this open space, by calculating from one quarter of the circumference found by the line, is brought into the contents as timber, which will take off more of the excess; and these two circumstances, in a number of trees of various shapes, may be nearly equal to the half of that excess. Timber must be hewn to prepare it for sawing, and generally is so before it is carried. If it is properly hewn, the four segments hewn off and wasted in a log of timber equal to a cylinder of the above dimensions, is ·1276 of a foot: if this waste be taken into the account (as, from not being brought into use, as timber, it ought to be) it is almost equal to the other half of the excess, the whole being ·2732 of a foot. Hence it appears that the buyer will have very few, if any, more cubic feet in a quantity of timber, than is measured to him by customary girt-measure.

Tapering timber, measured at one length and girt, contains more in customary measure than is made of it; but this excess is of no benefit, it being, in general, thrown away in the thick ends of the slabs. Hewn timber is measured by a customary method, the diameter being taken for the side of the square; and if unequal sided, that is, if the diameter is more one way than the other, a mean proportional is found for it. From its not being hewn to what is termed *die-square*, the true contents are much less than this customary measure makes it, 40 feet girt-measure being equal to 50 feet hewn-measure, and if hewn lightly, to more: this difference is known to persons concerned with timber, and the price per foot is in proportion. Foreign timber is hewn to die-square, and in that case the solidity is equal to the measured contents. To show the difference between die-square and round timber, suppose that two logs of timber were placed by each other, one of them round and the other hewn die-square, that their contents are equal according to the respective methods of measuring each, and that they are both of one price per foot; I have no doubt that the die-square log will be taken by any buyer; for general purposes, in preference to the round, notwithstanding all the advantage customary girt-measure may be supposed to give it. How long this customary method of measuring round timber has been in use, I know not; perhaps our ancestors knew as much of the circle as we do, and judged that (such circumstances as have been mentioned considered) the taking one quarter of the circumference for the side of the square, as it would rather give the buyer the turn of the scale, would be but right; and that the measuring of a timber-tree as a cylinder or frustum of a cone, as it would not give the buyer his due, would be wrong.

A point on the slide-rule to find the contents of a cylinder from the length in feet, and one quarter of the circumference in inches, is easily found; for the area of a quarter of the circumference of a circle being 144, is nearly at 10·64 on the line D. Mr. Hoppus, or others before him, could have calculated tables for timber-measuring in this manner, had it been the best; but, perhaps, the old customary method is as well as any that can be found.

If I am one of those whom *Measurage* is pleased to style "pretended timber-measurers," I must remain so. I think (I beg his pardon if I am mistaken) that he is a theorist in the art, who has never been scratched in passing among bushes, to see and measure timber, otherwise he would have observed the irregularity in the circumference of trees, and from his knowledge of the circle, would have been of a different opinion in respect to the mode of measuring them.

I am, Gentlemen,

Your obedient servant,

T. M.

BALLOON GOVERNOR.

Brick Lane, Spitalfields,
London, June 12, 1824.

GENTLEMEN;—Having read S. M.'s proposition for a balloon governor, in No. 41 of your scientific work, allow me to observe, that I have some small claim to an invention of a similar nature, as far as regards the mode required by the aëronaut of ascending or descending as frequently as he may think proper, during his aërial excursion, without any waste of the gas, which invention I had publicly shown for some time prior to the appearance of S. M.'s communication, at the Two Brewers, Brick-lane, Spitalfields. It was my intention to have called on Mr. Graham to have asked his opinion of the apparatus, when seeing S. M.'s statement, I thought proper to relinquish the design for the present, as his plan bears so much on the one that I have adopted. At the same time, I am well aware that there are many difficulties still to overcome before I can expect either his plan or mine to answer all purposes. It will be necessary, for example, that the weight of the balloon should be increased as little as possible, and that the apparatus should work not only quickly, but without much labour.

Your obedient servant,

JAMES FROST.

QUADRATURE OF THE CIRCLE.

GENTLEMEN;—I have read more respecting the "quadrature of the circle" in your Magazine than I have understood, owing (I suppose) to my deficiency in mathematical knowledge and experience; so, without presuming to argue on this abstruse subject, I beg leave to advance my simple idea of the matter as a problem for the decision of the profound mathematician.

As it is an indisputable truth, that the exact contents of the area of a circle is found *by multiplying half the circumference by half the diameter*; as certainly as that is truly done, so certain are we of a certain number, or sum total; and I have never been led to doubt but that the perfect square-root of any number might be exactly obtained; why, then, should not such square root be the exact square of the contents of any area of a circle? For instance, if 100 should be the contents of a circle, would not 10 be the exact quadrature, or side of a square of equal superficial contents with the circle? or if 144, surely 12 would be the square-root, &c. &c. Now, as I have gone the entire depth of my mathematical knowledge in the above proposition, or query, I hope the learned answer, or answers, which may be advanced in your most laudable Magazine, to show me my deficiency, and convey general information, may be given in that *plain verbal manner*,* which may convey the intended information without logarithms, algebra, or any of those profound means which cannot be intelligible to more than one-tenth part of your readers. You will surely forgive my presumption in offering this hint, as your Magazine is confessedly for the purpose of *communicating knowledge to those who are in want of it*, rather than displaying the knowledge of the learned on a *technical pinnacle* above the reach of the uninitiated. Q. Y.

IMPOSTURE EXPOSED.

London, June 9, 1824.

GENTLEMEN;—My object in troubling you with these lines is, to prevent some people from being cheated by an impostor.

* Is there not too much vanity in many learned persons under *displaying* their knowledge than conveying it? I conceive it to be the duty of the learned to translate all they offer to general reading into a *generally known* diction.

A designing fellow is now exhibiting, in Finch-lane, what he calls "Perpetual Motion without Deception!" Now this perpetual motion is as complete a deception as was ever attempted to be foisted on the public. It consists of a ball, vibrating from a pendulum, by means of a piece of steel, like a straight watch-spring, which spring communicates with machinery, completely hidden from the spectator, but by means of which, the projector regularly winds up this perpetual motion at different times. Yet one time this impostor used to show off in another part of the town; but a watchmaker of the neighbourhood constructed a piece of machinery of exactly the same sort, and exhibited it publicly, explaining at the same time the contrivance by which it was kept going, and the pretender was soon driven away.

Hoping that this exposure may have a similar effect in making him shift his present quarters,

I remain, Gentlemen,

Your obedient servant,

C. C———N.

P. S.—One of the absurdities of this perpetual-motion scheme is, that the impostor says that he can stop it, and set it a going when he pleases, or that it will, at his bidding, set itself going!!!

INVENTOR OF THE SPINNING JENNY.

"—— While unobtrusive merit starves unknown,
Nor heeds his claim to 'vantage."—*Old Book*

GENTLEMEN;—Whilst reading the very sensible remarks of "Tom Tell-truth" the other day in No 12 of your excellent Magazine, I was particularly struck with the *misleading paragraph* of "Arkwright being the ingenious inventor of the *spinning jennies*." It is not much known, that during his chin-scraping operations, he weekly pulled the nose of the real inventor—a poor illiterate cabinet-maker of the name of Brown, a fellow of infinite genius and most excellent fancy, and perhaps equal as a machinest to any one in the country: from him, in the course of barber-shop gossip, and familiarity, he extorted and heard the basis of the *invention*, and by superior cunning and hardihood, set about it, gained the profits and the credit for *ingenuity* which he never possessed!

I believe Brown is still in existence in some obscure part of London, a living instance of neglected genius!*

I am, Gentlemen,

With much respect, yours, &c.

ARGUS.

AIR-WEIGHING MACHINE.

GENTLEMEN;—In No. 39 of the Mechanic's Magazine is an engraving of an Air-Weighing Machine. Now, in my humble opinion, there is an error in the construction of the machine, and more error in the directions for using it. If I judge rightly, the piston ought not to be taken out of the cylinder, but weighed in its place, with the cock M open, for the friction will add to the weight of the piston. Then if the piston is pushed to the bottom of the cylinder (after being weighed), and the cock M shut, the exact pressure of the atmosphere will not be ascertained; for the air which remains between the cock M, and the bottom of the cylinder, will most certainly expand as the piston rises, and will, in a certain degree, counteract the pressure of the air at the top of the piston; therefore, the cock M ought to be placed as close as possible to the bottom of the cylinder. But I think a valve would be much better than the cock M. In weighing the piston, the valve might be kept open by the hand, or otherwise.

Gentlemen, by inserting the above, you will oblige yours, &c.

E. BACON.

INQUIRIES.

No. 38.—RELATIVE POWERS.

It is very desirable to have, in a tabular form, a comparative series of the different powers of some of the most common and effectual machines. As the basis of this table, I propose the number of pounds that *a man* (accounting the human frame as the best medium of comparison, on account of its being that with which we are most accustomed) can raise one foot high in an ordinary day's work of eight hours. I should then be glad of a similar calculation with respect to the Horse—the Windmill—the over and under-shot Water Wheels—the Steam Engines, at their different pressures, &c. &c.

The power of the Windmill, of course, depends on the velocity of the wind (in this instance suppose eight miles per hour), the length of the arms, and the area of the canvas.

(R+I+N)[n].

* Can this be true? Surely he has only to make himself known.—*Edit.*

NEW PATENTS.

To Joseph Luckcock, of Round Cottage, Edgebaston, near Birmingham, gentleman, for his improvement in the process of manufacturing iron.—15th May—6 months.

To Thomas Parkin, of Bache's-row, City-road, Middlesex, merchant, for certain improvements in machinery or apparatus applicable to or employed in printing.—15th May—4 months.

TO CORRESPONDENTS.

P. S.'s communication respecting Emigration to Canada, is intelligent and patriotic; it does credit to the body of London Citizens to which he belongs: but, as we have reason to know that most of the measures he recommends are now in a course of adoption by the Colonial Department of his Majesty's Government, we think it better not to enter on the subject at present.

G. A. S. and Mr. Yule are requested to send to our Publishers for letters addressed to them.

W. T. has been anticipated in his account of the Dial-Chamber Lamp. The description which we first received will have an early place.

The information desired by M. A. B. has already been given, in p. 299, Vol. I, and p. 45, Vol. II.

Communications received from Mr. Pickering—Mr. James Marsh—K.—W. E. — Vapor — Quodlibet —E. W.—Mr. Pasley—Q. T.—Mr. Deacon—Querist—Mason Jones—H. B.—J. B.—Vindex—Montis—Mr. Wedderburgh — Majertingun—W. B.

Communications (post paid) to be addressed to the Editors, at

THE PUBLISHERS,

KNIGHT AND LACEY,

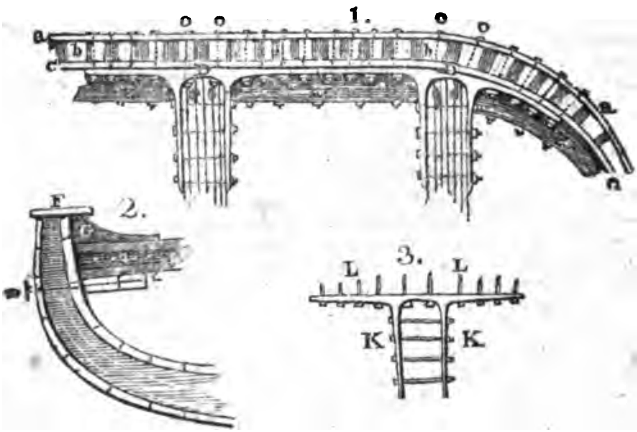
55, *Paternoster-Row, London.*

T. C. Hansard, Pater-noster-row Press.

Mechanic's Magazine,
Museum, Register, Journal, & Gazette.

Every man carries about with him a touchstone, if he will make use of it, to distinguish substantial gold from superficial glittering, truth from appearances.—*Locke.*

No. 45.] SATURDAY, JULY 3, 1824. [Price 3d.



CAREY'S IMPROVEMENT IN SHIP-BUILDING.

Gentlemen;—If you think a description of my new-invented iron-knee, and the manner I fasten a ship's-side, would in any way prove beneficial to merchants, ship-owners, and others concerned in shipping, I shall feel great pleasure in seeing it in your useful Magazine. I never yet saw a ship's-side that did not work considerably; here I have pointed out a method that renders it totally impossible for the ship's-side to work, or move in the least.

I am, Gentlemen,

Your very humble servant,

Edward Carey,

Inspecting Shipwright and Surveyor of Shipping at Bristol; Naval Architect, &c. &c.

Description of the Engraving.

Fig. 1, *a a*, the plank on the side; *b b*, the heads of the timbers; *c c*, thick plank, 3½ inches thick, which goes all round the ship, and which the end of the beam butts against; D D, the iron-knee; E E E, the horizontal clamp, 7 inches thick, and 13 inches wide, into which the beam is dove-tailed 3 inches down, and bolted through the end of the beam; *o o o o*, bolts which go through the side into the throat of the knee.

Fig. 2, F, the plank-sheer; G, the water-way; H, the beam arc of the knee; I, the bolt, which bolts the edge of the water-way, and streakes together through the side; J, the horizontal clamp under the beam; *m*, one of the bolts, which goes through the side, and horizontal clamp clenched on a plate inside.

Fig. 3, Mr. Carey's new-invented iron-knee, 2½ inches thick, and 5 broad; K K, the cheeks, to receive the beam; L L, the bolts, to fasten to the side.

WYNN'S IMPROVEMENT IN CHURCH AND TURRET CLOCKS.

84, Dean-street, Soho.

GENTLEMEN;—As one of the objects of your very useful work is the promotion of useful arts and inventions, may I claim a small space in it to lay before the public the principles of some improvements I have made in church and turret clocks? Perhaps no piece of mechanism at present manufactured, possesses imperfections in a greater degree than the clocks in common use. It has been ascertained, by an experiment made on a clock at the Royal Military College, which is one of modern construction, and consequently a fair criterion to judge by, that the spring called the "counter-spring," which is placed under the shank of the hammer, to prevent it from chattering on the bell, opposes a resistance equal to a reduction of four-fifths of the force generated. Now, I believe that engineers do not calculate to lose more than *one-third* of the expended power in steam-engines, where air-tight pistons cannot be dispensed with; and these oppose a much greater resistance by friction, than any object necessary to be called into action in clock-work.

That every person may judge for himself of the great deficiency of power in church clocks, it is only necessary for him to compare the sound produced by any of them, with that produced when a bell is rung with a rope. The sound of the church-bell is so feeble, that it is rendered useful only to a very confined neighbourhood.

The counter-spring, which is the great cause of this imperfect vibration, I have found means to get rid of, by taking advantage of the re-action which takes place on the collision of the elastic bodies, the hammer-head and the bell, and catching the hammer at the extreme height to which it rebounds, by a very simple apparatus; I thus not only prevent that very great portion of resistance before pointed out, but I am enabled, by the same means, to increase the generated force, by taking advantage of the accelerated force of falling bodies, in, at least, a three-fold proportion; for when a counter-spring is made use of, it is impossible to produce a great perpendicular fall of the hammer, as the spring would then have no command over it.

To enable the public to judge of the advantages to be derived by this system, I will make a comparison between the force of one of these improved hammers, and of one on the old plan, if applied to a clock already in use. Suppose the generated force of the old hammer be represented by 100; from the experiment before mentioned, it appears, that four-fifths of that 100 is lost. Now, if one of the improved hammers be applied to the same weight, and if the same perpendicular fall be given to it, as it meets with no resistance, it will of course fall with the full force of 100; but if a hammer of one-third the weight be applied, and it be raised to three times the perpendicular height, the power required to raise it will be equal, but it will fall with three times the force, according to the laws of falling bodies; which three, multiplied by 100, would raise the force of the new hammer to 300, while that of the old one would be reduced to 20.

Obvious as the advantages of this improvement are, and though it has been honoured by a premium from the Society of Arts, yet every effort has been used by interested persons to prevent its adoption. Need I ask whether it is right, that the public should be deprived of the benefit of a useful invention, because it does not accord with the interests of a few opulent manufacturers? I call on them thus publicly to state their objections to the improvement, if they have any, that I may have the means of replying to them, and that the public may be enabled to judge whether they are acting on sordid, mercenary, and illiberal principles; or, whether the advantages my plan holds out, are fallacious.

The most convincing argument which I can make use of in favour of my improvement is, that it has been in use nearly twelve months, where it gives the most perfect satisfaction by the great increase of sound which it produces; nay, more (a circumstance which does not frequently attend persons who first put new inventions into practice), it never has once mis-perfomed or required the least alteration or attendance since the first day it was fixed.

Several minor improvements I have made, which will be found of great importance to the certainty of performance, to the durability, and to the effect produced by these useful machines, some of which have not been published, and of which I will give you a description for a future Number. I beg leave to refer your readers, in the mean time, to p. 105, Vol. XL, of the Transactions of the Society of Arts, &c. for a more particular elucidation of the subject.

I now cheerfully leave my case to a candid public, trusting, that in this enlightened age, there will be found persons who are ready to give encouragement to a man whose most anxious wish is to see the Arts of his country in the highest state of excellence.—I am, Gentlemen,

Yours, most obediently,

W. Wynn.

P. S.—It may be necessary to state, that the improved hammer apparatus is perfectly distinct and separate from the clock, and can be applied to any one now in use, at a very trifling expense. I engage, also, to keep it in a perfect state of repair, for any length of time, for five shillings a year in London.

As I have been put to much expense of postage, I must beg that my country correspondents will defray it in any communications they may wish to make.—W. W.

We subjoin, for the better information of our readers, the more particular details contained in the description laid by Mr. Wynn before the Society of Arts, and to which he refers:—

"On the axis of my hammer is a ratchet, and a click is made to act in it, which has a spring, like the hammer-spring of a gun-lock, which will force the click both against the ratchet and (by a small change of position) away from it. There is a lever on the ratchet which goes under the click, and which forces the click away from the ratchet when the hammer is raised to strike the blow, and, consequently, gives liberty for the hammer to fall; but, just before it strikes the blow, the lever comes in contact with an other lever attached to the click, and brings it again in contact with the ratchet, ready to catch the hammer at any height to which it may rebound.

"Much friction is occasioned by the pivots of the hammer becoming rusty from their exposure to the atmosphere, which causes a considerable resistance to its draught, and which I have found means to prevent, by putting a brass collar over the pivot, so as to form a sort of cup or receptacle for oil, which collar enters freely into a groove in the collet in which the pivot-hole is made. By filling with oil the pivot-hole, which is closed air-tight at the end on the outside, the oil will flow over into the cup, where it will be retained by the pressure of the atmosphere and by attraction of cohesion, and will completely exclude all moisture from the pivot, which by this means will be prevented from becoming rusty, and will very much reduce the resistance both in the rising and the falling of the hammer.

"I have also found a great resistance in the common mode of lifting the hammer by a hammer-tail, both from the great length of space which the pin has to pass along the hammer-tail, and the difficulty of making the oil remain on a straight long surface, and that, in an inclined position, subject to continual jerks by the falling of the hammer; so much so, that, when I have found the striking-part of turret clocks stopping by the cold inclement season, I have made them go by fresh oiling the hammer-tail only, a proof that the resistance of that part of the clock has considerable influence on its performance. I have succeeded in lessening this friction by the application of a compound-toothed sector on the pin-wheel of the striking train instead of pins, which acts in a simple-toothed sector instead of a hammer-tail, and which reduces the friction in the proportion of twice the versed sines of twelve angles of 3° 45′, and twice the versed sines of 45°. I have made the compound-toothed sector by cutting a wheel of ninety-six teeth, and filling out six teeth and leaving six, alternately all round the wheel, and the simple-toothed sector of the same radius as the wheel with six teeth, instead of a hammer-tail to act in it; so that when the teeth of each branch of the compound sector have passed through the simple one, it lets it fall in the same way as the pin would let the hammer-tail fall. Besides lessening the quantity of friction, the resistance to the train will be equal in all positions of the leverage, and the oil will adhere far more tenaciously to teeth than to a plane surface, and it must be the means of preventing the mis-performance of the clock by the inclemency of the weather, a thing which often occurs, and which is attended with much inconvenience, particularly where a workman is not at hand to remedy the defect.

"The same principle is applicable to the lever of the unlocking detent, to relieve the watch part from a great portion of friction in unlocking the striking part. In the model I now produce, I have made a pinion of twelve with two of its leaves filed out, which represents the axis of the motion-wheel, which revolves by the power of the watch part once in an hour. This pinion, or rather toothed sector, as it revolves, gathers up a toothed sector with ten teeth of a circle of 144 teeth, whose radius is as twelve to one of that of the pinion; and when that part of the pinion which has lost its teeth comes round towards the axis of the sector, it will of course let the lever fall, and the striking part will be released. On the scale which I have made the model, I produce 1·3 inch of motion at the end of the lever; to accomplish this quantity of motion by the spiral curved plate (the best method now in use), the smallest radius of which is ·5 inch, and the largest one of 1·8 inch, there will be a plane of 7½ inches pass under the lever; but to produce the same quantity with toothed sectors of the proportion of twelve to one, the length of whose legs are 2·7 inches, and ·225 inch, the friction will be only as the versed sines of ten angles of 2° 30′, and the versed sines of ten angles of 30°, which, compared with 7½ inches, gives the relative proportion of the friction of the toothed sectors, and the spiral curve. Beside so materially reducing the friction, I produce the necessary quantity of motion by a lever, viz. the pinion, at only ·225 inch from the center of motion, instead of its acting at from ·5 inch to 1·8 inch from the centre, which it would do if the spiral plate were used, which of course lessens the resistance on the watch part in the proportion of those numbers.

"All turret clocks are susceptible of being altered, and all or either of the new principles may be applied to any which are now made. In such clocks as are in the habit of stopping in cold weather, the application of the toothed sectors would be the means of preventing that inconvenience, and in those where it might be desirable to extend their utility by increasing the sound of the bell, the application of the new hammer would attain that object in a high degree. By the application of all the new principles in the manufacture of turret clocks, the weight of the hammer will be so lessened, and the friction of drawing it so reduced, that comparatively small machinery will lift them, and that too with more certainty and accuracy than the large machinery will lift the hammers now in use, because the diminution of the general dimensions of the work will lessen the friction in all its parts, and the expense of the manufacture will be lessened very materially thereby. Any number of hammers may be raised by the toothed sectors.

The principles are applicable to the construction of common house-clocks, and would be a great improvement to them, without materially increasing the expense of their manufacture. In fact, all the levers of the repeating work might be put in motion by the toothed sector, which, as it would reduce the friction, would cause a greater certainty of performance, increase the durability, prevent the necessity of repairs, and cause the clock to keep time more correctly."

EXPLANATION.

Portsmouth, June 7, 1824.

GENTLEMEN;—I should not have felt justified in monopolizing more of your time on the subject of R. B.'s objections to various parts of my letter, in page 22, Vol. II, of your Magazine, were it not to confess myself in error; an acknowledgment which, I trust, I shall never be ashamed to make. I must, however, at the same time, in justice to myself, state what I conceive to be the magnitude of the error.

I was not unaware of the existence of those laws which he states I have transgressed; but from the manner I have ever been in the habit of viewing them, I have been led to think the conclusions they justify, rest on such nice and fine-drawn reasoning, and require such a stretch of mind to comprehend, as to come more properly under the head of imaginary than real. That I may not be misunderstood, I will venture, in one particular instance, to exemplify this remark, although I am aware that my explanation will not satisfy a mathematician.

R. B. states, let any rod be suspended on an axis, passing at right-angles through its centre of gravity; and it must be sufficiently obvious, that it is capable of motion, though its centre of gravity remains at rest. I will not so directly fly in the face of established laws, as to deny the correctness of this; but by following up my mode of argument with a view to illustrate this position, we shall arrive at a point, the existence of which we cannot conceive, and yet such imaginary point, I am quite aware, is admitted to exist. In a long rod, suspended in this manner, and set in motion, the extreme ends will describe the arcs of a large circle; and the arcs described by any number of points, taken at various distances from their point of suspension, will vary exactly in the same proportion as their distances from it; so that, by advancing nearer and nearer to the centre, the arcs become less and less. Now, the centre of gravity being coincident with the centre of motion in this rod, the motion of every particle of matter above the centre will be in a direction contrary to that of every particle of matter below it; and as this motion becomes less and less towards the centre, it is concluded (*and justly so*) that there must be a point within which does not move at all; because, if it did move, there is as much reason why it should move to the right as to the left; and as it cannot do both, it must be stationary. This is a conclusion which we cannot, by any mode of reasoning, avoid; but it leads us to a point far beyond our conception, and one which, *in real fact*, *does not exist* but in the imagination; for, *looking at it practically*, we cannot conceive any particle of matter so fine, but that it may still be divided and subdivided; so that, if we consider the centre to consist of a particle, however small, still we know it must contain other particles within it; and if so, those on the extremity will partake of whatever motion may have been communicated to the rod, and will not, therefore, be at rest. If, then, we admit the infinite divisibility of matter, we cannot arrive at any indivisible point, or any one, *which does not contain centre within centre*. If we still follow this up, we become lost, and arrive at precisely the same *imaginary* point, which the previous argument led us to; but, as I before said, it is a point which not only common sense cannot discover, but which the most assiduous application of the most energetic mind cannot reduce within the boundaries of our limited conceptions. Practice and theory, we know, are often wide apart. R. B.'s observations are *theoretically* correct; mine were intended to be *practically* applied, and are, therefore, *not theoretically* correct. In short, it seems to me, that this question hinges entirely upon the divisibility of matter, and involves us in a difficulty which is unavoidable in the consideration of every subject that has any relation to this property. The famous problem of two lines always approaching each other, and never meeting, turns upon the same property of matter; and if we be justified in arguments on things *which have real existence*, in admitting, *as in this case*, the identity of what we cannot feel, see, or conceive, then this problem may be demonstrated with the greatest mathematical accuracy. But I question whether *such* admissions, however correct on paper, would not lead us into innumerable *practical* absurdities.*

So much for this: and now, with regard to the tendency of a body downwards, I know, of course, that if we place a piece of wood at the bottom of a tub of water, the wood will rise to the top of the water, *because its gravity is less than that of the medium through which it has to pass;* for the same reason, any body will rise through the air, if *its gravity be less than that of the air;* but these bodies would fall, were it not for the interposition of some denser medium. Thus, in the first instance, *the wood would not have risen but for the water, nor would vapours rise but for the air.* There is a certain number of general laws, to which the motions of all bodies are subject; there are, also, many other laws subservient to these, and if, in any experiments on a particular body, we seem to come to different conclusions, each apparently equally well supported, the only fair way of coming at the truth, is to consider the question as perfectly unconnected with and independent of every other body, and to go back *to those first general laws which affect all bodies indiscriminately.* Thus, I may take away the *atmosphere*, if it interfere with my

* I must not here be understood to object to such admissions, *considered merely as admissions, whereupon to found an argument;* but I object to them in the *shape of facts, which have real existence.*

intended experiments; so, also, I may take away the *water*, &c.; but *I cannot take away the attraction by which every body is drawn to the earth*, in a greater or less degree. Let us now go back to the properties of matter, one of which says, *all matter attracts and is attracted:* now, although circumstances may intervene to prevent the *natural effects* of the law, *the principle will still exist. Vapors* are attracted towards the earth in common with every other body; *they have, therefore, a tendency to fall;* but the *atmosphere has a greater tendency to fall*, because it is heavier, or more attracted; if, therefore, a light vapor be surrounded by atmosphere, instead of the vapors rising through the atmosphere from its tendency to rise, the fact is, that the atmosphere itself sinks, from its greater tendency to fall, *and the superior gravity of the atmosphere being more than sufficient to balance the effects of attraction on the vapor, overcomes its tendency to fall, by forcing it up.* Lastly, I have stated, that if we endeavour to produce perpetual motion, by an horizontal movement of the acting power, "*such a body would come precisely within the laws of a pendulum.*" R. B. cannot discover any analogy between an horizontal motion and a pendulum. A pendulum receives its impulse from gravity, and each vibration, from various external impediments, becomes less and less, and at length the motion ceases. An horizontal wheel receives its impulse (perhaps) from a spring, and each vibration, from the same cause, becoming less and less, the motion of this too will ultimately cease. This is all the analogy I ever imagined to exist between them; and although the moving power in each case is difficult, I cannot but think that such analogy does exist. After all, I really feel myself so unequal to argue with that mathematical precision which R. B. requires of me, that I am content to admit he is right, and I am wrong. And, as I conceive his sole object was to convince me of my error, he may rest satisfied with having attained it, these remarks having been made, not with a view of proving myself free from such error, but merely with a view to lessen its magnitude. Whether I have succeeded in my main object, in endeavouring to establish the non-existence of a self-acting machine, is quite another question.

I am, Gentlemen, yours, &c.

HENRY DEACON.

STEAM-ENGINE POWER.

GENTLEMEN;—As your correspondents, S. Y. (p. 229, Vol. I), and William Andrews (p. 90, Vol. II), appear to me to have gone very wide of the mark respecting the power of steam-engines, I have taken the liberty of sending you a calculation which, I believe, will be found to be tolerably correct.

Before I proceed further, I would just remark, that these two writers have calculated upon a power which they cannot make use of. W. A. takes 2½ lbs. from the safety-valve, and adds to them 15 lbs. the square inch upon his piston, making together 17½ lbs. But if W. A. is a practical engineer, he ought to know that the 2½ lbs. have nothing at all to do with the calculation of the power, or pressure upon his piston; for as long as the steam in the boiler is stronger than the atmosphere, the engine will always work up to its full power; and if he will be at the trouble of fixing an indicator to an engine of Bolton and Watt's, that is considered to be carrying its full load, he will find the pressure not to exceed from 14 to 15 lbs. upon the square inch. If ever the pressure in the cylinder exceed 15 lbs., the extra expense in fuel will always overbalance the advantage said to be gained by the extra pressure, and it cannot, therefore, be taken into the calculation of the power of steam-engines.

I shall now proceed with my own calculations, and beg that your readers will keep in view the following particulars:---First, the area of the piston; Second, the number of feet it passes through in a minute; Third, the friction of the machine; Fourth, the power lost by changing the motion, from a reciprocating to a circular one; and, Fifth, that as it is impossible to make a pure vacuum, we cannot calculate upon more than 14 lbs. pressure upon every square inch of the area of the piston. Now, taking 14 lbs. to be the true pressure, we have next to inquire, what proportion of power is there lost by friction; and this cannot be accurately ascertained, and can only (I presume) be estimated by experience and close application to the subject. Suppose, then, we say 1-5th for friction; besides this, every one knows that 1-3rd is lost by making use of the crank to change the motion from a reciprocating to a circular one. The case, then, stands thus: 14 lbs. — 1-5th, or 2·8 — 1-3rd, or 4·6 = 6·6 lbs. = all that is left for what W. A. calls working-pressure.

As both your correspondents have quoted Bolton and Watt, we will try how the above statement agrees with their engines and calculations. It is well known that they never make the cylinder of a 20-horse-power engine more (and seldom less) than 24 inches diameter, the piston of which makes 22 double strokes, of 5 feet each in one minute, = 220 feet; and a one-horse power, according to them, must lift 33,000 lbs. one foot high in one minute.

Then the area of $24 = 452{\cdot}39 \times 6{\cdot}6 = 2985{\cdot}77 \times 220 = 656870{\cdot}28$ lbs. = what the engine will lift one foot high in one minute.

And $\frac{656870{\cdot}28}{33000} = 19{\cdot}9$ horses' power: here, then, we come almost as near to Bolton and Watt, as it is in the power of calculation to bring one man's ideas to another. The above calculation will hold good in all cases, with a little alteration of the frictional number, which must be altered before we can ascertain the true power of any other cylinder than the one above; this is owing to the very great difference there is between the friction of large cylinders and small ones, in proportion to their respective areas; it being much greater in a small than a large one.

If any of your more able correspondents will favour us with a true proportion, and a ready calculation of friction between small and large cylinders, they would confer a very great benefit upon their brother-mechanics; if no one attempts it, perhaps in a little time I may try at it myself.—Your humble servant,

J. K., *a Man in the Moors.*

MECHANICAL GEOMETRY.

(Continued from p. 233).

Thus far we have treated of *lines and angles* only; we will now proceed with the definitions, &c. of superficies.

Definitions.

8. A superficies is geometrically considered as generated by the motion of a line, in the same manner as a line is generated by the motion of a point, and has length and breadth only, and, *mechanically*, it is the surface of any body, without having regard to the thickness of it.

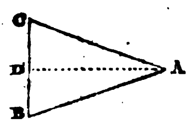
9. Superficies are either plain or curved; a plain superficies is that on which if we apply a straight edge in any direction, it will touch it throughout its length; in this case the plane is said to be true. Curved surfaces are either regular or irregular; regular when a mould or templet can be made by which it can be formed, or a *plane* by which it can be worked; all other surfaces are irregular.

10. Plane surfaces are distinguished according to the nature or number of the lines that bound them.

11. Planes bounded by three lines are called triangles, and are either right angled, or oblique angled. Right angled if any two of the lines forming it are square or perpendicular to each other, or form an angle of 90 degrees; oblique angled if otherwise.

THEOREM IV.

In any triangle, if two of its sides are equal in length to each other, the angles opposite these sides are also equal, or contain an equal number of degrees.



Let A B C be any triangle, of which any two sides, as A B and A C, are equal each other; we are required to prove that the angle C, opposite the side A B, is equa the angle B, which is opposite the side A C.

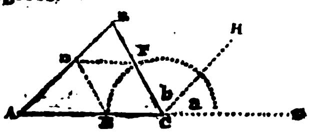
Let the triangle be cut out, as in Theorem II; then divide the side C B in two equal parts, as at D; join A D, and cut it through; lay A B on A C, to which it corresponds; you will then perceive the line C D will correspond to B D; and therefore the angle A C B equals the angle A B, as was to be shown.

Hence, the converse of this theorem may be shown, viz. that if in any triangle two angles are equal to each other, the opposite sides will also be equal to each other; for by the angle A B D or A C D, we shall find that A B will correspond to A C.

Note.—Triangles having two sides equal to each other, or, which is the same thing, having two equal angles, are called by geometricians *isosceles triangles*.

THEOREM V.

The sum of the three angles in every triangle is equal to two right angles, or 180 degrees. Let A B C be any triangle; we have to prove that the triangle at A added to that at B, and that at C, are together equal to two right angles, or 180 degrees.



Let the side A C be continued as to G, and from the angle C draw B H parallel to A B; then, according to what has been shown in Theorem III, the angle A will be equal the angle a, and the angle B equal the angle b, because the angles A and a are made by the line A C G crossing the parallel lines A B and b H; and the angles B and b are equal, because they are the ultimate angles formed by the line B C crossing the parallels A B and b H, and which may be made evident to the senses by cutting off the angle B by the line D F, and the angle A by the line D E; and drawing the semicircle described, it will be found that the angle B corresponds to the angle b, and the angle A to a, and the three angles C b and a make up 180 degrees as a semicircle.

Hence may be easily shown the following Corollaries:—

1. If any side of a triangle is produced, it will make an angle with the other side, which is equal to the two opposite angles; that is, if A C is produced, as to G, the angle B C G will be equal to the angle A, added to the angle B; for we have shown that the angle B is equal the angle b, and the angle A equal the angle a; therefore both together, that is, A and B will be equal a and b, or the angle B C G.

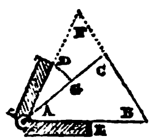
Note.—The angle B C G is called the external angle of the triangle A B C.

2. Hence the external angle is greater than either of the opposite angles A and C; for as it is equal to both the opposite angles, it must be greater than either of them taken separately.

THEOREM VI.

In every triangle the longest side is opposite the greatest angle.

Let A B C be any triangle, and the angle at C greater than that at A or B; we have now to prove that the side A B opposite to the angle at C, is longer than either A C or B C.



Let a carpenter's rule be opened to an angle equal to that at C, and apply it to the angle at A, as shown at D A E; then, because the angle at C is greater than that at A, the angle D A E will be also greater than C A B, and the side of the rule D A will diverge from A C, and therefore can never meet B C, unless we produce B C and of the rule tend to the point C of the line B C, it must be shut from A D to meet in F; hence it is evident, that to make the leg A B

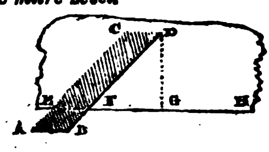
Dine G, therefore, when the angle or opening of the rule corresponds to the distance G B, it will make a less angle than the angle at C; or it will make an angle equal to that of A, which is contrary to the supposition on which we set out; or perhaps, more plainly to be comprehended, we must, to make the rule tend to the points B C, diminish the angle D A E, and the same arguments will apply if the rule is made to correspond to the angle at B.

Corollary 1. Hence, as geometricians term it, we have the converse of the proposition, viz. that in any triangle the greatest angle will be that which is opposite the longest side.

By the consideration of these theorems or triangles, the following problems, as practically useful to the mechanic, present themselves:—

Problem 5.

To know whether the instrument called a *mitre square* is true or not; or to draw a line which shall be a true *mitre bevel*.



Let A E C D F B represent the instrument known amongst workmen by the name of a *mitre square*, of which A E F B is the stock, and E C D F the blade.

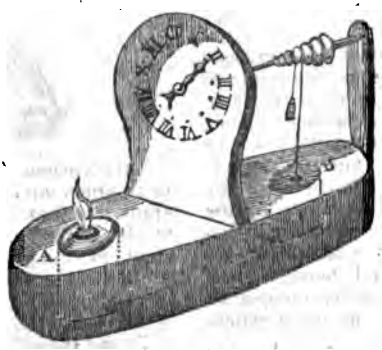
Let E F G H be the edge of a board, &c. made perfectly straight; apply the *mitre square*, and draw any line, as F D, and also draw any line, as G D, square to F G, or making a right angle to it; then if F G is equal to G D, the instrument is true; for we have seen by the 4th Theorem, that when the sides F G and G D are equal to each other, the angles at F and D are also equal; and by the 1st Corollary to the 5th Theorem, that the angle D G H is equal to the angle at D, added to the angle at F; hence, the angle at G being a square, or equal 90 degrees, each angle at F and D will be equal to half that at G, that is, the half of 90 degrees or 45, the true angle of a mitre.

Thus, to draw a line that shall be a true mitre, nothing more is necessary than to draw two lines square to each other, and of equal lengths, as F G and G D, and join their extremities, as F D, which shall be a true mitre line.

G. A. S.

(To be continued.)

CLOCK LAMP.



To the Editors of the Mechanic's Magazine.

Parson Drove, near Wisbeach,
May 8, 1824.

GENTLEMEN;—You well know that many of those who are in the habit of burning a light in the night, ofttimes in their waking moments wish to know, "how goes the time." If you think the sketch and description of a *clock lamp* sent herewith can, in any way, be useful to them, you will give it a place in your very useful publication.—Yours, &c.

John Peck.

Description of the Engraving.

A B are two vessels made of tin, about 1¼ inch diameter, and the same in depth, communicating at the bottom by a small tube. In A burns a floating wick; in B, a float balanced over a cone-like rool, by a small weight hanging on a piece of fine silk; the rool should contain several grooves, and vary in diameter from ¼ to ½ inch. The gradual burning of the oil in A, will cause the float B to fall, thereby turning the rool, which being fixed on a wire communicating with the hand, through the face, will point out the hour of the night. It is necessary to adjust the index to the true time when the lamp is lighted; and some little attention is requisite at first, to place the silk in the proper groove on the rool, which acts as a sort of regulator to the quick or slow burning of the oil.

STEAM NAVIGATION.

To the Editors of the Mechanic's Magazine.

Chelsea, June 21, 1824.

Gentlemen;—On reading Mr. Deacon's very sensible letter respecting the rate of going of a steam-boat with the tide, compared to her sailing in still water, it strikes me that both Mr. Deacon and your correspondent have overlooked a very material circumstance, viz. that as the vessel moves at the rate of 8 knots an hour, and the tide at only 2 knots, she must, consequently, move out of the reach of all pressure from the tide; but as she cannot move forward until a certain quantity of water is displaced, and which, from its having already received a particular bias from the tide, is rendered more difficult than where the water has received no previous impulse, her advancement is, in a certain degree, retarded. This lateral pressure may be, perhaps, rendered more obvious by supposing a vessel sailing along the coast with the tide running in shore; the body of water nearest the shore is easily displaced by her bow; but the same impetus which assists her in displacing that portion easily, prevents her displacing the portion on her other side, which, from meeting the tide, forms a continual pressure that gives her head a constant tendency towards the shore. I am, therefore, of opinion, that a tide running at the rate of 2 knots, can be of little advantage to steam-boats going at the rate of 8; the only advantage I see, must arise from the tide affording a greater purchase to the paddles than in still water, which advantage may, perhaps, be counteracted by the water requiring a greater power to force it aside, and its greater tendency to collapse.—I am, Gentlemen, yours, &c.

J. B.

BALLOONING.

Gentlemen;—I find in Nos. 41 and 42 of your valuable and widely-circulated Magazine, that you have laudably given publicity to several contrivances for more effectually governing balloons, and likewise a method of rendering them more safe, by the addition of a cane-hoop; it may perhaps not be deemed irrelevant to state what has been attempted in this way before, as it may possibly lead to some contrivance that is likely to benefit the sublime art of aërostation.

It appears that the Duke de Chartres, and the two brothers, Charles and Robert, were the first aëronauts that made use of a governor. They ascended with an inflammable air-balloon of an oblong form, measuring 55 feet by 34, from the Park of St. Cloud, at 52 minutes past seven in the morning; and after remaining in the atmosphere about 45 minutes, descended a little way from the place of ascension. The incidents of this voyage are among the most singular upon record. The large balloon contained a smaller one filled with common air, the intended use of which was to regulate the ascent and descent, and, in fact, to be the means by which they intended to govern the balloon, without the loss of either gas or ballast. At the place of ascension the barometer stood at 30°12. In three minutes they were enveloped in a dense vapour, which prevented them from seeing the earth; and were attacked by a kind of whirlwind, which in a moment turned the machine from right to left. The shocks they suffered entirely prevented them from using the *oars and helm* they had provided for guiding themselves. Never, in their apprehension, did a more dreadful scene present itself to any eye than that in which they were involved. One unbounded ocean of shapeless clouds rolled beneath, and seemed to forbid their return to the earth, which was still invisible, while the agitation of the balloon became greater every moment. They cut the cords that held the interior balloon, which consequently fell on the bottom of the external balloon, just over the aperture of the tube that went down to the boat, and stopped up that communication. A gust of wind from below drove the balloon upwards to the extremity of the vapour, and the sun again appeared in all its radiance. They were now, however, assailed by other fears; for, the heat of the sun, and the diminished pressure of the atmosphere, caused so great an expansion of the gas in the balloon, that they expected it to burst. They introduced a stick through the tube, to remove the inner balloon which covered its orifice, but the pressure of the dilated gas upon the balloon was so great as to render this impossible; they therefore continued to ascend, and their danger to become greater, till the barometer stood at 24° 36 inches, which indicated a height of about 5,100 feet. In this extremity, to prevent their total destruction by the bursting of the balloon, their only hope was, that a gash made in it would not spread so far as to be dangerous, by letting out the gas too rapidly. The Duke accordingly made two holes in the balloon with one of the spears of the banners, and these holes instantly become a rent of seven or eight feet. They now descended rapidly, and as soon as they came in sight of the terraqueous globe, they perceived themselves to be falling into a lake; but the celerity with which they threw out about sixty pounds weight of ballast, a little protracted their flight, and caused them to descend about 30 feet beyond the edge of the water. None of them were hurt.

Very different was the fate of the adventurous and unfortunate Pilatre de Rosier (who, the reader will recollect, was the first aëronaut) and his companion Romain. He had projected and executed the plan of using both an inflammable air-balloon, and a Montgolfier, as a governor in conjunction with it. The inflammable air-balloon was uppermost, and suspended by ropes at the distance of several feet; below it was the rarefied air-balloon, and beneath it there were, in the usual manner, suspended successively the grate for the fire, and the gallery for the passengers. By a proper regulation of the fire, it was expected that they could raise or depress the whole without being under the necessity of *losing the gas* from the upper balloon. The inflammable air-balloon was of varnished silk, and about 37 feet in diameter; the other was of strong linen, and only ten feet in diameter. They ascended on the 15th of June, 1785. After they had been in the air about 20 minutes, having only a feeble and changeable wind, and when they had reached only three quarters of a mile from the place of ascension, their actions displayed an anxiety to descend. They were seen letting out the gas, while at the same time the balloon containing it was observed to be much expanded. In a moment after, the inflammable air-balloon was discovered to be on fire; one moment more it collapsed, and the two passengers Rosier and Romain were precipitated with tremendous rapidity to the earth. The former appeared quite dead when he was taken up, the other had some faint signs of life, but expired almost immediately. Upon examination, the lower balloon was found to be entire, but the upper one was much burnt. It appears, therefore, that some sparks from the fire had flown upwards, and ignited the inflammable air-balloon.

There can, I think, remain little doubt, after what has been stated, that the Duke and his companions owed their safety more to the interior balloon, which acted on the principle of the parachute, by keeping the upper part of the exterior balloon distended while it was descending through the atmosphere, than any thing else, and I believe that such a contrivance is much more applicable than any of the means hitherto proposed. For I am quite at a loss to imagine how a condensing apparatus (such a one I mean as would be absolutely necessary to draw off the gas with sufficient rapidity, in order to produce any sensible effect) could be carried up. Its great weight will, I fear, constantly act as a barrier to its use, to say nothing of the labour which it would entail on the aëronaut, who has other things to attend to on such a voyage.

In reference to the safety hoop, the following fact perhaps may be thought worth attention. A balloon was constructed by the brothers Charles and Robert at Paris, in November, 1783, which was of a spherical form, and measured 26½ feet in diameter; the upper hemisphere was covered with a net, which was fastened to a *strong hoop*, incircling its middle, and called its equator; from this equator proceeded ropes, by which was suspended a car for the passengers. On the first of December 1783, the two aëronauts ascended in the balloon from the garden of the Thuilleries, and after attaining a great height, made signals of their safety. They descended in a field about 27 miles from Paris. As the balloon still contained a considerable quantity of gas, Charles re-ascended alone, and in ten minutes he estimated his elevation at 1,500 toises (9,591½ English feet); the pressure of the atmosphere being here greatly diminished, the balloon swelled considerably; he therefore let out some of the gas, after which, as the balloon's power of ascension was increased by the expansion of the gas in a higher degree, then it was diminished by the loss, he rose to a still greater height; the barometer, which at his departure stood at 28 inches four lines, had now fallen to 18 inches 10 lines, whence it was calculated that he had ascended to the height of 9,745 English feet. The thermometer, from about 47 degrees of Fahrenheit's scale, had now sunk to 21 degrees. He continued in the air about 33 minutes, and by occasionally pulling the string of the valve at the top to let the gas escape, he descended about three miles from the place of ascent. The descent was extremely easy, owing, no doubt, to the hoop equator keeping the balloon distended, and acting in the manner before stated, as very little gas could have remained in the balloon. This, although evidently a very effectual contrivance, will, it is feared, never be brought into use, owing to the hoop being so cumbersome, as it is now the general practice of aëronauts to carry home this balloon with them.

I am, Gentlemen, your obliged
and humble servant,
JAMES MARSH.

DRY ROT.

Chatham Dock-Yard.

GENTLEMEN;—On the subject of *dry-rot* I beg to make a few remarks in addition to those you were pleased to insert in No. 34.

The opinions of Nauticus (pages 149 and 202) respecting the ill consequences of felling timber before the sap descends, may be considered conclusive, as being long those of the most experienced in both house and ship-building; but I cannot agree with him, in comparing all trials for prevention with Mr. Lukin's experiment; nor can I by any means agree with his sweeping conclusions, that all EXTERNAL applications, and all artificial modes of seasoning, are useless. Mr. Lukin's charring and exploding process, bears no similitude whatever to an aqueous or even a galvanic application. There was but little rationality in the basis of that experiment: to impregnate wood with gas, by the means resorted to, was impossible; and the idea of dispossessing oxygen from the wood by saturating the timber with the opposite of oxygen, or to keep the preventive at a distance, and thereby encourage dry-rot, was as silly as the experiment was ill performed. Similar deficiencies of judgment and similar inutility and fatal consequences, should not be predicated of aqueous applications; nor is it liberal to limit applications and trials to any one species of means or manner whatever: *we should neither despair nor discourage.* In the next place, Nauticus seems as if he were ignorant of the fact, that essential change may be effected in one body, by *contact only* with another.

The *admission*, that a fluid may enter about half an inch only into wood (made by Nauticus the principle of his objection to *external application*), is in my mind the most favourable circumstance possible towards preventing dry-rot; and although I doubt that wood in boiling "is not wet more than three quarters of an inch" (if it were only from the weight of water absorbed), that portion is all-sufficient to make it subservient to the removal of all other internal waters in the wood. Water, in its compound state, prevents dry-rot; and if that state, be not within the power of art to be maintained, the alternative is to get rid of the water entirely. Then, if we cannot *inject* into wood, by soaking or boiling, and to do so by extreme pressure be inconvenient, let us *abstract* humidity from it. One medium by mere similar, causes the diffusion of another, as air coming in contact with more condensed air. The plates and solution of the galvanic battery touch at surfaces only; then why overlook the very great advantage of a medium already inserted one-half inch deep into the wood, and which is in contact with the destroying juices within, to apply *externally* such other medium as shall draw all humidity from the center to the surface of the wood? I have no doubt but Sir Humphry Davy could dictate or devise a method of piling timber, by inserting between each pair of logs such a species of plate, as that the series thus constructed should, with safety to the timber, galvanise all humidity away. In nature universally it is more by contact than intermixture, that change is effected; and transfer takes place from the direction where pressure is greatest. *The system* is under a state of general pressure; and as rarity and density make atmospheric changes, from the effects of the same power do all transfers of matter in the formation as well as decomposition of bodies originate. Galvanic piles of wood or of pasteboard are active while humid, and when their humidity is dissipated, are left uninjured. I see no reason, therefore, against the idea of an arrangement being effected, whereby stacks of timber would be preserved by their own galvanic action: nor let this be considered as making a convenience of what some will call a novel discovery in science; call the change which bodies undergo by contact, galvanic, or any thing else, I acknowledge no *power* in physics but what is the consequence of pressure from the effects of motion; no effect but transfer from place to place of unchangeable elements; and as this operation goes on through the entire of the system, why may not the effort be made to do the same with timber as we do with metallic plates and acidulous solutions? In a word, all chemical change of bodies being but change of place of these particles, it is with wood as with every thing else, the general pressure forces particles where resistance is least; and to promote this it is that we put media in contact, which causes the change or transfer to be in the direction required. If *external* application be useless, why are all parts of a ship now soaked in salt water in our dock-yards? Mortar or its humidity must enter wood, even less than salt water from soaking; yet in the former case is the wood preserved by little more than *external touch*. Nor is Mr. Lukin's hasty experiment any reason for saying that wood cannot be seasoned by art: give it time, temperature of weather, and free air, and all imprisoned water will inevitably disappear. Nauticus has missed the fact completely, when he gives his opinion (and it may be a very influential one; for the leader is often more generally followed, than individual judgment consulted) against *external* applications, because some very clumsy ones indeed have been applied speculatively; as what application can be considered other than *external*? The deepest wound is touched by the cataplasm only *externally*, while the remotest parts are equally acted on.

Nauticus says, that "the moisture which spring-felled timber contains, when evaporated, leaves a *secretion*" (*deposit*, I ween) "in the vessel, which, when it meets with a peculiar state of atmosphere, undergoes a fermentation, and causes ultimately a decomposition of the timber." *Fermentation* is resorted to as a substitute for reason, as we prefer visible cases in all illustrations, although the really acting powers of nature are *invisible* universally. The materials for fermentation are not present, and the result shows the absence of fluidity, on the presence of which fermentation depends. Other water than the juices of wood, and wherein no deposit is likely, gives dry-rot. A deposit left by the absence of humidity from evaporation, could no more decompose wood, than sand could decompose cold iron; and hence I see no reason to change the opinion which I formed and published in the year 1815, and 1820, that the decomposition of water is the cause of the decomposition of wood, by which certain of the elements of the latter are evolved with those of the water, and hence the wood suffers loss of weight, and texture, and is converted to that dissicated, friable state, which is called the *dry-rot*.

T. H. Pasley.

MECHANICAL POWER.

Mr. Owen, in a letter which he has published about his fanciful system, says, that it was estimated, six or seven years ago, by three of the most experienced cotton-spinners in Great Britain, that the quantity of cotton-thread produced on an average by each worker, compared with that which one person could have spun on the single wheel, as was the practice before the late inventions of Arkwright and others, was as 120 to 1; that is, that one person produced as much as 120 could have produced previously to these inventions. Now, as there are about 280,000 persons engaged in the spinning of cotton-thread in this country, 280,000 multiplied by 120 gives 33,600,000 as the number of operatives who would have been required to produce as much cotton-thread on the old plan as is spun in Great Britain at present. Political economists generally reckon that one in five of the whole population is a producer; but if we say one in three, then it follows that it would require the working part of a population of more than 100,000,000 of human beings to produce, on the old single wheel, as much cotton-thread as 280,000 workers are enabled to manufacture by means of mechanism!!!

QUADRATURE OF THE CIRCLE.

Gentlemen;—It is certainly true, as Q. Y. states, that the area of a boiler is found by multiplying half the circumference by half the diameter; but that the *perfect* square-root of *any number* can be exactly obtained is not so certain; for unless it be a square number, its root will always be a surd, or such a root as cannot be expressed in rational numbers. But Q. Y. seems not to understand the meaning of the "quadrature of the circle," which is to determine *the exact ratio between the diameter and circumference*; for these being known, the area, and consequently the side of a corresponding square, may be readily found. Now, admitting that 100 be the area of a circle, according to his supposition, and 10 the side of a square, having the same superficial contents, yet we have still to learn how to come at the *dimensions* of that circle; for by this process we have no data to find either the diameter or the circumference. If Q. Y., who seems to understand the square-root, would try to find two whole numbers, one of which should express the side, and the other the diagonal of a square, he would then form some idea of the difficulty of squaring the circle; for I believe the circumference of a circle will be found equally incommensurate with its diameter as a diagonal line with the side of its square.

G.

IMPROVEMENT OF THE MAC-ADAMIZED ROADS.

Gentlemen;—Having passed into St. James's Park by the new entrance from Pall-Mall, I observed that the new court-yard there formed, is Mac-Adamized; and as it must, of necessity, take an amazing time to render its surface smooth, from being used only on state occasions, I beg to suggest a very simple, yet effectual mode by which that end may be accomplished, and which is applicable to all roads made in the above manner. Let a quantity of tar, which can now be obtained from the gas-works at a very cheap rate, be melted and poured over the stone, in sufficient quantity to fill up the interstices, and to cover the whole to the depth of about 1-4th of an inch; before it cools, sift some fine gravel or sand over it: it will then form one of the finest and hardest surfaces that can be conceived. Margate Pier, which is the principal promenade in the season for its visitors, has been done in this way; and though it is several years since the tar was put on, it remains as firm as it was at first.

I am, Gentlemen,

Yours obediently,

H. C.

ANSWERS TO INQUIRIES.

No. 1.—TREVETHICK's ENGINE.

In answer to Mr. George Hamilton's inquiry respecting the Hydraulic, or Water-Pressure Engine, I beg to observe, that engines of this description were applied in Cornwall long before that of Captain Richard Trevethick's, at Wheal Druid Mine. About the close of the seventeenth, or the beginning of the eighteenth century, these engines were in common use in this country, under the directions of *Mr. Coster*, who, I have been informed, came from Germany. Since that time, they have been applied as opportunities offered. The principle of the hydraulic, or water-pressure engine, is quite plain and simple: the power of these engines of any given size, is in proportion to the height of water that impinges against the piston. It may be applied with the same degree of facility for winding, as it can be for pumping. These engines may be considered a true method of ascertaining the degree of friction that attends gudgeons, valves, and boxes, or any other bearings that may be connected with the same, as they will raise an equal column of water of the same gravity as that with which it is supplied to the same height, less the friction of gudgeons, valves, and boxes, and the velocity of the falling column of water that presses against the piston, which must be calculated agreeable to its velocity, in proportion to that of falling bodies. There was a pumping engine of the same description as that alluded to, of Captain Trevethick's, at the Druid Copper Mine, at Gunnes Lake Mine, in this county, which did the work allotted with as much regularity, and at as little expense as any other machine of an equal power, and which did credit to the builder. There is, also, a large one working at present, near this place, applied for pumping, and which works exceedingly regular. For a correct statement of the power of these engines, the inquirer may refer to a paragraph of the Mechanic's Magazine for March, where is stated the full power of a ten inch diameter piston, with mineral and pure water, and a fall of 300 feet. These engines do not occasion more friction than any other kind of an equal power.*

A. B.

St. Anstell.

No. 10.—STEAM-ENGINE CHIMNEYS.

The common height for chimneys of large steam-engines in use in this county (Cornwall) is from 60 to 80 feet. The orifice is round, from 3 to 4 feet diameter. As the price of fuel so materially affects the mining interest of this county, it is the policy of every engineer so employed, to construct the best method of generating the greatest quantity of steam with the least coals; it is the common practice to make the flues and passages around the boiler, particularly the passage of the regulator or damper, much smaller than the orifice of the chimney, which is of equal diameter at bottom and top. The diameter proposed by the "Inquirer," is quite sufficient for an engine of 24-horse power: respecting the height of chimneys, I believe the engineers in this county have not yet proved the required height needful to consume the fuel, that it may produce the greatest effect: 120 feet, as proposed, far exceeds any height yet practised in this county. A. B.

INQUIRIES.

No. 39.—TURNING.

Union, Pennsylvania, May 20, 1824.

Gentlemen;—Having become a subscriber to your very useful publication, and observing that it is common to request information on any particular subject through the medium of its columns, I take the liberty of proposing some queries relative to the art of turning, on which subject an article or two has already appeared in your Journal.

1st. What method is now most generally adopted in cutting screws in the lathe? Has any late discovery rendered this art more simple or easy to acquire?

2nd. In turning delicate screws for connecting telescope-tubes, &c. (where such extreme precision is requisite) how are the male and female screws made to correspond with such a great degree of accuracy?

3rd. Is there any method of giving the

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* A very ingenious and efficient plan for diminishing this friction, has just been communicated to us by Captain A. Vivian under whose direction it has been adopted at Norh Roskear Mine, Cornwall. The working gear of the engine employed there, is the same as is generally applied to Watt's single steam-engine, with this material difference, that in the latter the valve is lifted perpendicularly, while in the former it is moved horizontally, and in this the value of the improvement chiefly consists. Capt. V. having kindly promised to favour us with a drawing of his engine, we shall shortly be enabled to give our readers a fuller description of its merits.—*Edit.*

first movement to a lathe, preferable to the old plan of the crank?

4th. What plan is best for turning eliptical or oval figures?

5th. What is considered the best material for mandrels and mandrel collars, and what is esteemed the best shape for the mandrel? And, in short, what is the plan of the best lathes now in use? and what have been the late discoveries in this branch of mechanism?

Although I am fully aware that some of your patrons (probably the most of them) are familiar with the lathe in its most approved shape and construction, and am also conscious that in London these inquiries may seem of a simple cast, yet, when it is understood that he who is making them is an American, and a resident of a part of the United States somewhat remote from the places where, if at all, such information could be acquired, there will at once, it is presumed, be a disposition to excuse and grant the request for information thus made.

AN AMERICAN.

P. S.—Are there any works in the English language on Turning? and what are they?

[It is a gratifying circumstance to find our little work made a medium through which thirsters after knowledge, even in the remotest parts of the earth, may make their wants known, and have them supplied. We beg to recommend the inquiries of our American friend to the early attention of our readers and correspondents.—EDIT.]

FRENCH POLISH.

Dublin, May 2, 1824.

I find in page 223 of the Mechanic's Magazine a receipt for a French polish; it is not however quite satisfactory. Several mechanics have followed it, and they find, that rubbing spirits of wine at the last, takes off the polish; they wish the receipt to be more particular, and to have the following queries answered: 1st. Is the wood to be set to dry after "the pores are filled up?" 2nd. How long does the entire take to dry? 3rd. How is it protected from dust till dry? I am anxious to know also, whether it must be rubbed hardly, either with the polish or spirits of wine, as also the different appearances of the wood during the process.

I beg also to state, that for dinner-tables I have for 20 years adopted the following process. One quart of cold-drawn linseed-oil has been simmered (but not to boil) for 10 minutes, and then strained through flannel; and to this ¼th of spirits of turpentine has been added. This, by being lightly put on daily, and each time well washed off, will, in about six weeks, produce a polish so durable as to resist boiling water, and be like a mirror for brilliancy. The chief thing necessary to observe is, to wash out any dirt with cold water before you apply the oil. It should be applied with linen, and wiped off with soft linen: it does not require *hard* rubbing. Should I see, by your invaluable Magazine, that any further information is required on this point, it shall be given.

James Mortimer Gall, in page 398, says, "if properly applied." What does he mean, or how applied? He wants to know how to dissolve copal. I say, with great respect to him, that camphorated spirits of wine *will* take it up. I took up one ounce in half a pint, by reducing the copal to coarse powder, putting it into a glass vessel corked, with a small hole in the cork, and applying the heat of a spirit-lamp, till the copal was dissolved. You can also melt it in an iron ladle.—Your obedient,

JOSIAS MURRAY.

NEW PATENTS.

To John Dickinson, of Nash Mill in the parish of Abbotts Langley, Hertford, esquire, for his method of cutting cards by means of machinery, and also a process for applying paste or other adhesive matter to paper, and for sticking paper together with paste or other adhesive matter, by means of machinery applicable to such purposes.—20th May 1824—6 months.

To Thomas Marsh, of Charlotte-street, Portland-place, Middlesex, saddler and harness-maker, for an improvement in the art of making saddles.—20th May—2 months.

Communications (post paid) to be addressed to the Editors, at

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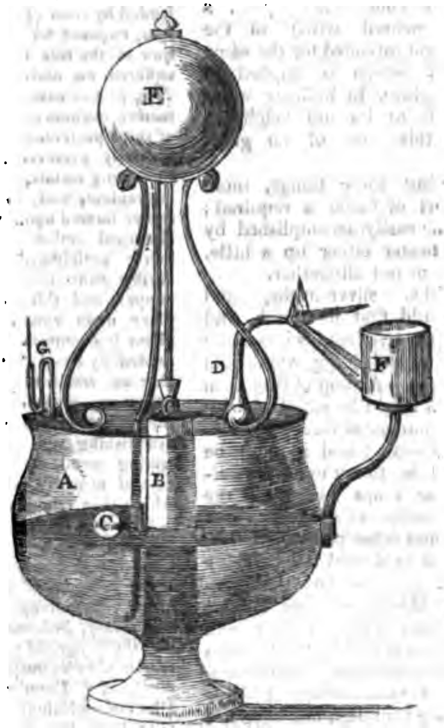
T. C. Hansard, Pater-noster-row Press.

Mechanic's Magazine,
Museum, Register, Journal, & Gazette.

To clothe the naked and feed the hungry is good; to teach men how to provide for themselves is much better.—*Ettrick*.

No. 46.] SATURDAY, JULY 10, 1824. [Price 3*d*.



STEAM-SOLDERING MACHINE.

Soho, Westminster.

GENTLEMEN;—As encouragers of invention, I take the liberty of presenting to you a design for a steam-soldering machine, hoping it may prove useful to some readers of your valuable Magazine, and members of the Mechanics' Institution.

A, is the body of the machine, intended to be of the shape of an urn, but flat on the top, or nearly so; the cover must be made to fit very close, otherwise the steam will find its way out, and weaken the effect. The whole should be made of copper or brass, as tin will not be strong enough. C is a ball-cock, marking the height of the water. B, a passage for the heater. D, a blow-pipe, which might meet the flame a little above the cotton or wick of the lamp. F, a lamp, which might be made to turn conveniently on a swivel; any oil will do. E, a reservoir of water, which, if rightly managed, would always keep the proper quantity in the urn; for, as the ball-cock is sunk, water would be let in to make up for the portion evaporated. The water, of course, should be hot or warm in both places, and the pipe that conveys the water to the urn, should go to the bottom of it, as exhibited in the drawing. G, a worm (but which perhaps may be dispensed with) of the same kind, and intended for the same use as that which is applied to all steam-engines, to indicate when the steam is at its full height—a matter in this case of no great moment.

In soldering some things, more than one sort of flame is required; this would be easily accomplished by pulling the heater either up a little, or half-way, or out altogether.

Goldsmiths, silversmiths, and braziers, would find it useful, and particularly the two last, as it is more fit for heavy and large work than small and light. A shop of fifty or a hundred men might be supplied with blow-pipes from one of these machines upon a large scale; and it might be so contrived as to act upon the bellows in those shops where a large fire is continually required for melting metals, and other purposes.

I have now explained this machine as well as I am able (my first performance in this way), and I hope both you and your readers will thoroughly understand it. Perhaps some person may think it worth the expense of a trial, which I have wished to give it myself, but have not been able, for want of the proper means and opportunity.

A GOLDSMITH'S APPRENTICE.

ANALYSIS OF COTEMPORARY SCIENTIFIC JOURNALS.

QUARTERLY JOURNAL OF SCIENCE, LITERATURE, and the ARTS. Nos. XXXIII. & XXXIV.

Prevention of the Corrosion of Copper Sheathing.

Our readers have been already made acquainted with Sir Humphry Davy's application of certain electrical combinations to the preservation of the copper sheathing of ships, and other purposes. The Lords Commissioners of the Admiralty have since enabled him to pursue his experiments on the subject on a very extensive scale, and the results, as communicated to the Royal Society, are most satisfactory.

"He found, that sheets of copper defended by from $\frac{1}{40}$ to $\frac{1}{150}$ part of zinc or iron, exposed for many weeks to the full flow of the tide in Portsmouth Harbour, suffered no corrosion; and that even $\frac{1}{1000}$ part of cast-iron exerted great protecting influence. Boats, and the sides of ships protected in this way, were also similarly preserved. Of the different protecting metals, cast-iron is found most convenient, and the plumbaginous substance formed upon it does not impede its electrical action. The *President* formerly anticipated the deposition of earthy substances upon the negative copper, and this he now found to take place upon sheets of copper exposed about four months to sea-water, and defended by from $\frac{1}{20}$ to $\frac{1}{30}$ their surface of zinc and iron; they became coated with carbonate of lime and magnesia; but this effect is easily prevented, by duly diminishing the proportion of the protecting metal, so as to prevent the excess of negative power in the copper, which then remains bright and clean.

"Many singular facts had occurred in the course of the President's researches, some of which bore upon general science. Weak solutions of salt act strongly upon copper, but strong ones do not affect it, apparently, because they contain little air, the oxygen of which seems necessary, to give the electro-positive power to these menstrua. Upon the same principle, alkaline solutions and lime-water prevent the action of sea-water on copper, having in themselves the positive electrical energy which renders the copper negative.

"The principles developed in the course of this inquiry, have suggested means of preserving instruments of brass and of steel, by iron and by zinc—a circumstance which has been already taken advantage of by Mr. Pepys, in inclosing delicate cutting instruments in handles or cases lined with zinc."

Elasticity and Strength of Steel.

Mr. Tredgold gives an account, distinguished by his usual acuteness and accuracy of some experiments which he has recently made on the elasticity and strength of hard and soft steel.

"The bars of steel used in these experiments, were supported at the ends by two blocks of cast-iron, resting upon a wooden frame, and a scale for weights was suspended from the middle of the length of the bar, by a cylindrical steel pin, ¼ inch diameter. To measure the flexure, a quadrantal piece of mahogany was attached to the frame, with a vertical bar sliding in two guides at its edge, and moving an index. The bar and index were so balanced, that one end of the bar bent with constant pressure on the specimen, and the graduated arc was divided into inches, tenths, and hundredths, and thousandths were measured by a vernier. A bar of blistered steel, of file hardness, 13 inches long between the supports, underwent no permanent alteration of form when loaded with 210 lbs. The temper of the bar was then successively lowered, and it was ultimately again hardened; but in these different states its flexure and resistance to permanent change of form remained the same. These experiments were repeated with bars of other dimensions, which were loaded till they broke, and hence the author also infers, that the elastic force of steel is not altered by temper, and that the force which produces permanent alteration, is to that which causes fracture in hard steel, as 1 : 1·66, and in the same steel, of a straw, yellow temper, 1 : 2·56.

"From comparisons of the strain required to cause permanent alteration in different kinds of steel, the author concludes, that in the process of hardening, the particles are put into a state of tension among themselves, which lessens their power to resist extraneous force, and the phenomena of hardening may be referred to the more rapid abstraction of heat from the surface of the metal, than can be supplied from the internal parts; whence a contraction of the superficial parts round the expanded central ones, and a subsequent shrinking of the latter, by which the state of tension is produced."

Effects of the Density of the Air on Chronometers.

Among the sources of error to which chronometers are liable, the effect of the variable density of the medium in which the balance vibrates, has been hitherto overlooked. From a series of experiments made by Mr. George Harvey, and communicated to the Royal Society, it appears that chronometers gain by being placed in air of less density than that of the ordinary state of the atmosphere, and that, on the other hand, they lose when subjected to air of greater than ordinary density. These experiments were made with a variety of chronometers placed in the receiver of an air-pump, or in that of a condensing apparatus. In respect to the influence of ordinary changes in the density of the air, Mr. H. remarks, that pocket-chronometers are more readily affected than loose chronometers, but that they all exhibit an increased rate under diminished density, and *vice versâ*. Mr. H. ascribes these changes to an increase in the arc of vibration, when the density is diminished, and to a diminution in the arc under increased density.

Self-acting Blow Pipe.

It is pretty generally known, that bottles of Indian rubber may be expanded to a considerable size by condensing air into them; but Mr. H. B. Leeson is the first who has applied bottles so filled to the purposes of a blow-pipe. The bottles he makes use of, vary in weight from half to three quarters of a pound, and may be readily procured at any stationers.

"To prepare them, they should be boiled in water till completely softened, which, if they are put into water already boiling, will generally be accomplished in ten minutes or a quarter of an hour. They must then be taken out and suffered to cool, when a brass tube may be fitted into the neck of the bottle, having a small cork screwed into it at one end, by which it may be connected with the condensing syringe, and to which the blow-pipe jets may be attached. There should be a milled projection on the side of the tube for the purpose of more firmly attaching the bottle to it; which may be effected by passing a ligature of waxed string round the neck of the bottle on each side of the above-mentioned projection. The bottle must next be filled with condensed air. After a few strokes of the syringe, a blister will be observed to form, which will gradually enlarge till the greatest part of the bottle (which must be selected uniform in substance and free from defects) has extended to a similar substance. The condensation should not then be continued farther. Bottles of the size I have mentioned, will generally extend from 14 to 17 inches in diameter without bursting; and I have occasionally extended them much beyond these dimensions; but in this, the operator must, of course, be entirely directed by his own observations. The Indian rubber varies in its quality: there is one sort which appears of a blacker hue before extension, but becomes very thin and almost transparent on condensing air into it; whilst there is another sort having a browner colour, which is much less yielding in its substance, and cannot be extended to the same thinness as the former. I have found both sorts to answer my purpose; but the above observations may be useful in determining the quantity of air which may be condensed into the bottles with safety. To apply these bottles when filled with condensed air, nothing more is necessary than to remove the syringe, and in its place to screw on a jet of such bore as may be required. On opening the cock, the air will be expelled by the elasticity of the Indian rubber, and its own condensation, in a strong and uniform stream, which, in bottles of the size I have mentioned, will continue from 25 minutes to an hour, according to the size of the jet. When once prepared, the bottles may be constantly expanded to the same size, without any danger of bursting. When the air is exhausted, the bottles will be found somewhat larger in dimensions, but may again be contracted by holding them before a fire, or a few minutes immersion in boiling water. This, however, is unnecessary; since no subsequent inflation will be found to increase the size of the bottle any further; and I have used the same repeatedly, without any apparent diminution of its elastic powers. The principal advantages of this blow-pipe are its great portability, and length and steadiness of action (in which I consider it much superior to the hydraulic blow-pipe), together with the perfect liberty at which, when properly mounted, it leaves the operator's hands. This blow-pipe is applicable to any of the gases, and may, I conceive, be applied with advantage to contain the explosive mixture of oxygen and hydrogen, as no inconvenience can possibly accrue from its bursting, beyond the lap of the bottle. This blow-pipe may be supplied with air or gas during an experiment, by having a separate communication for the syringe into the piece of tube before mentioned, and this will enable the operator to continue his experiments for any period of time."*

Changing the Residence of Fishes.

Dr. M'Culloch, who gave us an interesting paper, in a former Number, on the Herring, has furnished another still more so "On the Possibility of Changing the Residence of certain Fishes from Salt Water to Fresh."

"As far as this may be considered a question of economy or utility, it is not necessary to say much. It may, perhaps, abstractedly, be deemed of little consequence, whether an inhabitant of Germany is condemned to eat *roach* or *gudgeon*, or to regale on *whiting* and *smelts*; or, whether, in a Highland Lake, *John-dory* is to be substituted for *pike*, or *turbot* for *par*. But all the improvements in the details of human life may, if we please, be measured by the same rule. We have naturalized and domesticated the wild animals that walk and fly, to be our fellow-labourers, our companions, our servants in the chase, our amusement, and our food. Nature has given us *crabs* and *sloes*, which we have converted, by our industry and perseverance, into *golden-pippins* and *green-gages*. It is not an illaudible pursuit to apply to the uses of man all those bounties which Nature has spread around him; but on the possession and perfect enjoyment of which this law has been stamped, that without labour and industry, they shall not be attained. Yet, while on this question of economy, it may not be improper to suggest a few doubts respecting the prudence of that conduct, which, in this country, neglects the sources of real profit to be derived from cultivating the produce of its fresh waters. In France, it is said that the value of an acre of water is equal to that of an acre of land; and these ponds are rented by great fishermen, or fishmongers, who adapt their systems of fishing in such a manner as to ensure the greatest possible permanent stock of fish; removing the superfluous produce, which would otherwise be devoured or die, without injuring the future population, and thus producing a constant and regular supply in

* Blow-pipes, on this construction, may be procured, very neatly and conveniently mounted, at Mr. Newman's, No. 8, Lisle-street, Leicester-square.

the season, without the risk of exhaustion.

"In Germany, it is well known that the cultivation of *carp* and other fresh-water fish, is a regular object of attention; and although the proximity of the sea may cause us to treat with contempt the painful efforts of our neighbours to do that for themselves which nature has so bountifully done for us, it is, assuredly, not unworthy the attention of the proprietors of inland counties in Britain, to attempt to produce from fresh water, either rent or profit.

"The quantity of fresh waters existing in Britain is so considerable, as, with the exception of Switzerland, to exceed those of any country in Europe. From these, no profit whatever is derived; a Scottish lake, under a regular system of fishing and care, might probably far exceed in value the miserable tract of bog and rock by which it is inclosed. The canals of this country occupy a considerable space, and might, like ponds, be stored with fish, to the probable advantage of the proprietors no less than of the community. Even the rivers are unproductive, with the solitary exception of *salmon* and of *eels;* since the quantity of other fresh-water fish brought to market is far too insignificant to be an object of attention in a case like this, where so much more might be effected."

But can sea-fish be naturalized in fresh water? Dr. M'Culloch advances a large body of evidence which shows clearly enough, that the habits of many of the species are perfectly convertible, and that they thrive as well in fresh water as salt. The following is his conclusion:—

"The *flounder* and the *mullet* have been naturalized to fresh water; the whole of the fishes of analogous habits, and particularly those of the genus *pleuronectes*, might be habituated to inland lakes. The *turbot* and the *sole* would be very desirable objects of cultivation. If different species of *gadus* have been shown to be at least indifferent as to the quality of the water into which they enter, the *whiting* as well as the *cod* might possibly learn to inhabit our lakes or rivers, and thus become among the most accessible as it is among the most delicate of fishes.

"If the *smelt* could be naturalized in ponds, as I have here rendered more than probable, it would, from the esteem in which it is held, be a peculiarly desirable acquisition. The hints contained in this paper may possibly induce others, who have the means in their power, to assist in the execution of a set of trials which can succeed only in the hands of many, and which must necessarily be the work of time.

"It has been suggested, that as the flavour of fresh-water fish is far inferior to that of the marine species, the effect of naturalization would be to diminish their value as articles of food. This does not absolutely follow, although it may be thought probable from the case of the *mullet* above-mentioned, and by the fact that the flavour of the *salmon* is constantly diminishing from the time it has quitted the sea. If such should prove to be the case, it might indeed diminish the value of the acquisition; but it would not, therefore, destroy it: nor is it likely, that a *smelt* would ever sink to the scale of a *gudgeon*, or a *whiting* to that of a *roach*.

"I have already shown, however, that this deterioration of quality, so far from being probable, is not at all likely to occur; since, with this single exception, supposed to have occurred in Guernsey, and which is probably the report of prejudice, the flavour is really improved in all cases where the experiment has been fairly tried; and since the transportation, in Sicily, is made with this very object, and no other. At any rate, let the trials be made before any such condemnatory judgment is passed.

"I will only further remark here, that there is no very good reason why the *turtle* should not be naturalized. What an acquisition this would be, it may be left to the Court of Aldermen to decide. The animals of hot climates, that live in air, have been so; and why the submarine or amphibious ones should not equally admit of this change of habits, I know not, and nobody else does. The *turtle* might take its place alongside of the *peacock* and the *pintado*, and with his fellow-*turtles* of the land; while, if he choose to hybernate, he might find a dormitory in Loch-Lomond, or elsewhere, to pass the chilling hours of a Highland winter. And the change would be less than in the case of the land animals; since there is not such a difference of temperature in the one case as in the other.

"The merely temporary naturalization to our lakes and ponds in the case of sea-fish, would be no light acquisition to the gastronomer who might desire to have *turbot* before the season, or to reserve it at five shillings for consumption, when the price has risen to three guineas. If *cod* choose to live in the fresh Lake of Stromness-voe, there is no reason why we should not keep them in our own gardens till the day of giving a dinner comes round, or why Mr. Groves should not render the Serpentine a park for *surmullets*, instead of allowing it to be consigned to *frogs* and *tad-poles*. It is to be hoped, that the Fishmongers' Company will take these matters to heart, as in duty bound; and that, in the progress of perfectability, even the odious Canal in St. James's Park may become a repository of *turtles*, instead of what it now is, a Stygian nursery of Malaria and his black host."

(To be continued.)

GLASGOW MECHANIC'S MAGAZINE.

(*From a Contributor*).

We have seen about half a year's Numbers of a weekly publication, which has been commenced under this title, and have looked into its merits with something like the affection and anxiety of a parent. We are prepared to say, "All, hail!" to every ally in the cause to which we were the first to devote ourselves—the diffusion of scientific knowledge among the working classes; for we are convinced, that the more there are of such publications, the wider the desire for them must have become; and also that the *First* Mechanic's Magazine will not cease to be the *first* in circulation, till it has ceased to afford the same share of instruction and amusement which it now does, and to be conducted in the same spirit of candour and liberality which has gained for it the support of so many able and indefatigable contributors.

The Glasgow Magazine, though sold for the same price, is printed on a finer paper, and in a more showy manner than ours; but then it does not, on an average, contain one-half the quantity of matter, nor one-half the number of illustrative engravings that the London Magazine does. We wish (not evidently for our own sakes), that the projectors had adhered to our plan, and consulted how they could be most useful, rather than how they could best cut a spruce figure in the Gorbals.

The Glasgow Magazine is a clever work; but its cleverness is too much of the theoretical, privileged, and editorial order; it appears to allot but a small "corner in its toleration" to the vulgar communications of merely practical men: it does not encourage so much as we delight to do—the freest interchange of information among mechanics of every degree, in point of acquirements; it is too often churlish, snubbish, and repulsive; nay, so much does it disdain the wants of the uninformed, and the acquisition of new facts, that one of its latest notices to correspondents tells them, that the editors "have come to the resolution of not admitting any more questions, *unless the proposers transmit solutions along with them*"!!! Injudicious, unkind resolution.

The Glasgow Magazine addresses itself particularly to a class of men, who are told that they stand "*pre-eminent* above their fellow-mechanics in this island for the *great extent* of their scientific knowledge, and for *the wonderful* improvements they have made in the Arts and Manufactures for which they have *long been distinguished*," and that by these means, among others, they "have raised their native city to a pitch of opulence and grandeur *unrivalled by any other city in the kingdom*"! We have no intention of *seriously* disputing the validity of these pretensions; if the Paisley folks can read them with patience, so may we, that are but mere metropolitans. The only purpose for which we take notice of them is, to express our extreme regret that it should have been deemed accordant with the taste of a race of men so pre-eminent in scientific attainments and accomplishments, and, of course, so enlightened, to address them in language so fulsome and narrow-minded. What we have quoted, however, is modest, compared with what follows:

"THE SCOTCH AND ENGLISH."

"The Scotch understanding differs from the English as an encyclopædia done from a circulating library!! An Englishman is contented to pick up a few odds and ends of knowledge; a Scotchman is master of every subject alike!! In England, each individual has a particular hobby and favourite bye-path of its own; in Scotland, learning is a common hack, which every one figures away with, and uses at his pleasure"!!

We are grieved to see so much of what Mr. Christopher North would call mere *Balaam*, disfiguring a publication which has otherwise very considerable claims to our respectful consideration. How unworthy of that pure philosophy in whose cause it has enlisted, is this boasting and adulation! How injurious to the real interests of the Glasgow Mechanics themselves, are these assiduous efforts to foster in their minds exaggerated notions of their own importance, and utterly false ones of the merits of others! How opposed are all such odious comparisons to that brotherly regard and respect which all mechanics should be taught and encouraged to feel for each other, no matter to what county, city, or town they belong! How would the modest and benevolent Watt, whom it is the pride of Glasgow to have once ranked among its artizans, have frowned on such a spirit!

Among "the odds and ends of knowledge" so liberally assigned to the English mechanic, and which they do really possess, there is one which, if our Northern friends would condescend to make use of it, would make their "hack" "figure away" with a grace of which they seem at present to have no conception, and that is, *the knowledge how to be just and generous*. When the mechanics of London assembled to consider of the propriety of establishing an Institution for the cultivation of scientific knowledge, one of the first resolutions to which they came, was to acknowledge, frankly and gratefully, "the example which the Mechanics of Glasgow had set their brethren at large, in being the first to establish, on the principle of self-support and exertion, an Institution for their own instruction in the Arts and Sciences." Is it kind in the Mechanics of Glasgow, or in those who would wish to be regarded as speaking their sentiments, to return so handsome an acknowledgment with taunts and sneers? Oh, fie!

The *new facts* furnished by this Magazine (owing, no doubt, to the preceptorial character which it has assumed) are not so numerous as might have been expected from a place which is the seat of so many arts and manufactures, and where a competent share of learning is the boast of almost every one. We hope to see it improve in this respect. Among the best of its articles are those which relate to poor Cross, of Paisley, and his substitute for the draw-boy, of which we propose to give an abstract in an early Number. A few other specimens of more convenient length for quotation, we subjoin:—

A Grain Gauge.

M. P. D. thus describes a portable instrument of his invention, which seems calculated to be of great utility to the farmer or corn-merchant when he goes to market to buy or sell grain.

"It is of the steel-yard form, having a beam about 12 inches long (but made with a joint so as to fold), and a vessel of copper or tin, whose content is just 100dth, part of a firlot (quarter). By filling this vessel with wheat, or other grain, hanging it on the short end of the beam, and poising it, by shifting a moveable index on the long end, you can determine the weight of a firlot of grain in the short space of half a minute. This instrument can be folded up in a case, and put in the pocket."

Mode of Making Screw Tools or Combs.

"A nut must be made of the size of the tap, if a ½-tap a ½-nut, &c. Then cut a space out of one side of the nut, with a bevel to correspond with the comb to be cut, which place in the nut; make it fast in the vice, and screw it with the tap till the thread be full. By this method, combs may be cut more speedily and as well as those done with a cutter."

How to Bend Iron Pipe, without cracking.

"Fill the pipe with melted lead, and

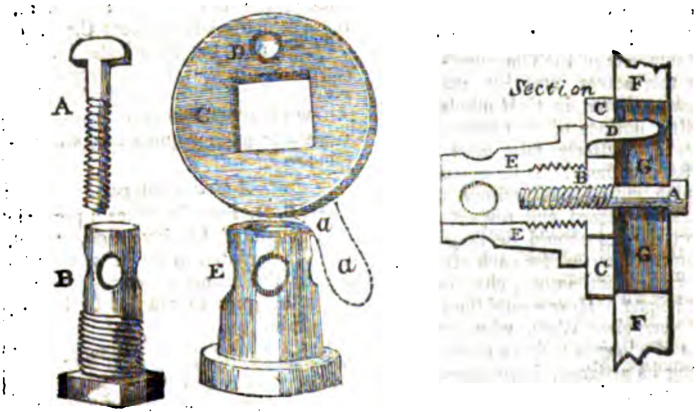
immediately on the lead coming to be fluid, and while it is yet warm, you will find the pipe bend very kindly into any form you wish. A hollow groove across a round piece of iron, suppose the round beak of a smith's anvil, of a size suitable for the pipe, may be useful to bend the pipe over. By keeping up the warmth, you may adjust the bend into any form you please, as iron will very readily bend at that heat. After having obtained the wished-for curve, it will be easy to melt the lead out of the pipe."

Easy Mode of fine-edging a Razor.

"On the rough side of a strap of leather, or on the undressed calf-skin binding of a book, rub a piece of tin or a common pewter-spoon, for half a minute, or till the leather become glossy with the metal. If the razor be passed over this leather about half a dozen times, it will acquire a finer edge than by any other method."*

* We have tried this mode, and find that it does indeed produce a very fine edge. —*Edit.*

LOCK SECURITY.



Bath, April 30, 1824.

Gentlemen;—Being in the habit of taking in your interesting Magazine, I observe in the one for April 10th, the description and sketch of machinery for additional security to "door and other locks." I now beg to send you a sketch and description of an invention of mine for the same purpose, which I had intended sending three months ago, but was prevented doing by a variety of occupations intervening.

A, is a piece of round iron, with a cross piece at one end, formed as a screw at the other. B is a stout circular piece of iron or brass, having at one end a square shoulder of half or three quarters of an inch in thickness; close to this shoulder, on the circular part, a screw is to be formed of three or four turns; and close to the other extremity of this piece, B, make a circular hole quite through. C is a circular or oval plate of iron or brass, of the same thickness as the square shoulder piece of B, but of greater diameter; in the centre of this piece, C, a square hole is to be cut through, to fit easily over the shoulder of piece B. D is a small piece of iron of half an inch projection, fixed in, and just beneath, the centre of one of the squares of the aperture in C. E is a hollow iron or brass circular tube, having a circular shoulder, which shoulder must be rather larger than the shoulder of B. Within this piece, E, must be formed, at the shoulder end, a corresponding screw to the one on B. At the other extremity of E a corresponding circular hole is to be made through, to come in contact with the circular hole in B.

The mode in which this additional lock security will operate is as follows:—

The piece A is to screw into the centre of piece B, on the side where the shoulder is, which is to be bored through, as far as the circular hole in B, with a corresponding screw of A. Then ascertain the thickness of the door to which you mean to apply this machinery; lengthen or shorten the piece A by means of the screw; introduce your cross-piece, A, into the key-hole, or, as may be, through to the inner side of the door; then turn the cross-piece transverse to the key-hole, leaving the shoulder of B as close in contact as possible with the key-hole.

The piece C is then to be slid on the shoulder of B, being made sufficiently large to cover the key-hole. The projecting piece D going into the lower part of the key-hole, keeps the transverse position of A from being displaced.

E is then to be screwed over B, tight against the plate C, the shoulder of E being rather larger than that of B, so that the shoulder of E may press against that of C.

The two circular corresponding holes in B and E coming in unison, you pass through the bar of your combination lock, or common padlock, as you please, and your key-hole is then secure from a pick-lock, or introduction of skeleton or false keys.

By making the circular holes longitudinally, you may apply two or more combinations, or padlocks, in case you wish to make any room or chest a deposit for joint security.

Another great advantage to a door that opens externally, having a key-hole, and no lock on it, is that by having a cross-piece, as A, with one side of the cross of a proper length, so as to bear against the inner side of the door-post, your door may be securely fastened.

To travellers, and persons travelling about for pleasure, who too often suffer from the insecurity of locks, this apparatus seems particularly worthy of attention. No injury is done by applying it, and it is of such light weight, as to be portable in the pocket.

I have another method of applying the combination lock to the same purpose, in a horizontal position, instead of the pendulous, as before described; the security is equal, and the appearance more elegant and pleasing to the eye. If a description of it would be acceptable, I shall feel happy in communicating it, on signification of such desire in any future Number.*

The machinery described for this same purpose in your No. 33, appears to me too slight, and attended with great inconvenience, in consequence of there being no means of contracting or extending the tube which passes through the key-hole, according to the various thickness of doors.

I remain, Gentlemen,

Your most obedient servant,

G. M. H——N,

Lieutenant Royal Navy.

LIGHT AND COLOURS.

No. I.

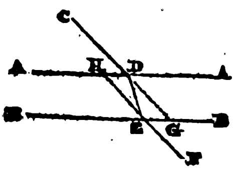
REFRACTION.

According to Sir Isaac Newton, LIGHT is composed of heterogeneous rays, possessing different degrees of refrangibility; and which, when separated, excite the sensation of the different colours,—red, orange, yellow, green, blue, indigo, and violet; and every colour in Nature is produced by the predominance or deficiency of some of those rays. The obscure colours, such as the dark shades of the tulip, are combinations of the prismatic colours, intermixed with black, or dark particles which exhibit no species of light; and the light colours, such as the pale tints of the rose, are similar combinations mixed with white, or particles which exhibit every species of light; for it is evident, that a perfect confluence of all the differently coloured rays, will exhibit the appearance of white, from the circumstance of the sun's light appearing colourless; and it may be further

* We shall be happy to receive it.—*Edit.*

illustrated, by imitating the colours refracted by a prism, on the circumference of a wheel, which, when made to revolve rapidly, will appear to be white. It is not, however, so clear that the precise colour of silver, or any of the metallic lustres, can be produced by any combination of the prismatic colours.

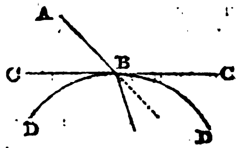
Refraction is the deviation of a ray from a straight line, in passing *obliquely* from one medium into another of different density. If a ray fall perpendicularly on any refracting surface, it will preserve an unaltered course; but in falling obliquely from a rarer into a denser medium, it will take a direction nearer to a perpendicular to that surface; and the angle of its deviation will increase with the angle formed by the incident ray and the perpendicular: when a ray passes from a denser into a rarer medium, the reverse takes place; for it will then be refracted in a direction farther from the perpendicular, and the angle of deviation, *in an opposite direction*, will increase with the angle formed by the emergent ray and the rarefracting surface.



Let A A, B B, be two parallel planes, the boundaries of a dense refractor, on which the ray C is incident at D; then will C be refracted to E, making the angle of deviation E D G, and, emerging into the rarer ambient medium, will be again refracted to F, making the angle D E F equal to the angle C D E; and consequently C D parallel to E F.

Hence, if the angle of incidences of a ray falling on a dense refractor be K, and its angle of deviation L, an emerging ray, of which the angle of incidence is $K - L$, will have its angle of deviation $= L$, and its angle of emersion $= K$.

If a ray fall upon a circular or spherical refracting surfaces, its angle of deviation will be the same as if it were incident on a plane surface forming the tangent to the point of incidence; and the same law regulates the refraction of a ray falling on the internal surface of a hollow sphere or cylinder.



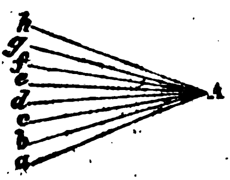
Thus, if the ray A be incident on the circular refractor D D, at B, its angle of deviation will be as the angle formed with the perpendicular to the tangent C C.

Although it may be assumed as a general principle, that the refracting power of different substances is as their density, which is indicated by their specific gravity, yet it is found that this is not universally true, as different kinds of glass possess various refracting powers—a circumstance which has not hitherto been satisfactorily accounted for. A ray cannot pass from a denser into a rarer medium, unless the angle of incidence, together with the angle of deviation, is less than a right angle. The greatest angle which can be formed by an emergent ray from glass into air, is about 49°; and if the angle of incidence exceed that amount, the angle of deviation will exceed 41°, making together 90°; and the rays which cannot emerge under those circumstances, will be reflected.

Hitherto, a ray has been considered as a homogeneal, or more properly, an inseparable stream of light; because the compound colours, orange and green, are produced by the intersection of the adjacent colours; viz. the red and yellow intersecting each other, produce orange; and the yellow and blue intersect each other and form green; and the other colours which are compounded with the blue, are produced by the accession of red rays in different quantities. In the following observations, a ray will be considered as containing all the different species of light as found combined in the light of the sun.

There is an erroneous notion very prevalent respecting the prismatic colours, *viz.* that there are seven distinct simple colours; whereas, all combinations of colours may be resolved into some, or all of the three radical colours—red, yellow, blue. This idea has probably originated in the injudicious application of the term "primitive colour,"—an expression quite inadequate to convey a definition of the nature and production of the seven colours into which the image displayed by the prism is usually divided; but it must be observed, that there is not, naturally, any such division; if the various shades between any two adjacent colours are to be enumerated, there is no reason why we should not divide them into seven thousand, as well as into seven. All that must be understood by a "primitive ray," is a ray separated by refraction; for, experimentally, it is unimportant whether it be a homogeneal red ray, or whether the fugitive rays of the adjacent yellow are blended with it, and form orange; because, when a ray is separated by refraction, all the confluent rays are equi-refrangible.

The following figure will explain the manner in which these shades are produced:—



Although the boundaries of the different colours are here represented by lines, they are not so defined in reality, but imperceptibly blended with *each other*, and with *darkness* at the extremities of the image. A is a ray separated by refraction into the different colours of which it is composed, in the following order: the least refrangible of the red rays fall upon *a*, and the most refrangible of the red fall upon *c*; the least refrangible of the yellow rays fall upon *b*, and the most refrangible upon *e*; the least refrangible of the blue rays fall upon *d*, and the most refrangible upon *h*; the accession of other red rays in different quantities, from *f* to *h*, as before-mentioned, form the indigo and violet; and the production of the other intermediate compounded colours, *b c*, and *d e*, is obvious, by inspection of the figure. R. B.

(*To be continued.*)

ALARM LIGHTS SUGGESTED.

Birmingham, April 14, 1824.

Gentlemen;—Permit me to suggest, that an alarm light might be advantageously employed to protect property from nocturnal robberies. Suppose, for example, a lanthorn were placed outside the attic-window of a house, or in any other suitable situation, with a shelf in it, supported or held up by a wire communicating with the lower part of the dwelling, and attached to an horizontal one passing across the doors and windows to be secured; suppose, further, that any two of the many combustible chemical substances which, on coming into contact, are instantaneously ignited, were put, some on the shelf and the other on the bottom of the lanthorn, the horizontal line would, it is imagined, be disturbed, if any door or window were burglariously entered; the perpendicular one would become detached in consequence; the shelf in the lanthorn would fall, and the combustible substances being brought into contact, would produce the alarm light desired. By introducing a lamp into the lanthorn, it might be lighted by the combustion of the chemical ingredients, and the signal, notice, or alarm, be by this means kept up for a considerable length of time.

All that I have aimed at, is to point out the principle upon which alarm lights might possibly be brought into use: their mechanism would admit of much variety.

I am, Gentlemen,

Yours respectfully,

X. Y. Z.

P. S.—I must seize the present opportunity of expressing a conviction of the utility of your work. It will, in my humble opinion, disperse much valuable knowledge, give birth to talent, nurture genius, gratify the emulous, nerve the unpersevering, and shame the indolent. It will, I could almost venture to affirm, produce, at no very distant period, a revolution in the character and condition of those who constitute the majority, and at the same time the most productive and valuable part of the community: and a revolution from a state of ignorance, sloth, or vice, to a state of knowledge, activity, or virtue, is to be considered horrible only by those who shudder at the very term, though applied to changes the most necessary and beneficial. The phrase is sanctified by that very progress of our planet, which is at this moment ushering in the beauties of Spring, to be succeeded by the fructifying warmth of Summer, and the golden harvests of Autumn. May, then, the tendency of your publication be that which its nature would lead us to anticipate; and may its pages continue to diffuse that spirit of philosophy, independence, and liberality, which has hitherto so peculiarly distinguished it, and is so eminently calculated to promote the mental vigour and moral improvement of the community at large.—X. Y. Z.

REMEDY FOR THE DRY-ROT.

Clarence-street, Rotherhithe.

Gentlemen;—As the subject of dry-rot has engaged the attention of some of your correspondents, I beg leave to offer to your notice a method for its prevention. The opinions respecting the cause of dry-rot are extremely various; but the most general is, that it arises from the use of oak timber felled in Summer, and not being sufficiently seasoned. But as the bark of a tree felled in Winter is useless to the tanner, the interest of the grower leads him to fell it so as to preserve the bark; and the timber is sold without inquiry from the buyer as to when it was felled. But (as your correspondent T. H. Pasley demonstrates), the sap or aqueous matter, of which the timber is full, undergoes decomposition, and dry-rot ensues, particularly if used where there is not a free current of air.

Oak timber is generally seasoned by laying on the ground after being felled, though sometimes more from necessity than choice; labour to remove it in the Spring or Summer being dear, it is suffered to lay till Winter, whilst the sap on the lower side rots off a considerable portion of the wood, and the upper side is rent by exposure to the sun and wind.

In case, too, of having to plough the land near it, it is extremely in the way. The method of preventing the dry-rot I should wish to propose is this: to bark the tree in Spring, and at the same time to lop off every branch too small, or unfit for timber. Then, through the bottom of the trunk, bore two holes, of about one inch and a half in diameter, so as to cross each other. Through these the sap would run out so as to kill the tree, and by seasoning in an upright position, all the aqueous matter would be completely removed, which, by laying on the ground, cannot be done, except within two or three feet of each end.

If the tree were then cut down in the ensuing Winter, the timber would be found of a remarkably hard and dry quality, so as indeed almost to resist the saw, and be at the same time free from rent or shake.

The most respectable and satisfactory reference can be given as to the efficacy of this plan (as it has been used on a large scale with the greatest success), by application to me at my address inclosed.

Gentlemen, yours respectfully,

Edward Morris,
Millwright.

VELOCITY OF SOUND.

By Dr. Olinthus Gregory.

(*Abstracted from a paper by Dr. G. in the Transactions of the Cambridge Philosophical Society for 824.*)

The results of the experiments hitherto made to determine the velocity of sound present an extraordinary discrepancy; thus—

	Feet per second.
Mr. Roberts assigns a velocity	1300
Mr. Boyle	1200
Mr. Walker and Duhamel	1338
Mersenne	1474
The Florence Academy	1148
Cassini de Thiery	1107
Meger	1105
Derham	1142
Muller	1109
Pictet	1130
Arrago	1106-32

A series of experiments undertaken by Dr. Gregory produced the following results:—

Velocity of sound.		Feet.
Fahr. therm.	27°	1094·2
Ditto	33	1099½
Ditto	35	1102
Ditto	45	1107¾
Ditto	59	1109¼
Ditto	60	1112
Ditto	64	1114¾ / 1116
Ditto	66	1116 / 1117

Of these results, some have been obtained in the day-time, others in the night; some when the sound has been transmitted over the surface of the earth, others when it has been transmitted over the surface of water; some are the result of direct sound, others of both direct and reflected sound; some from the report of cannons, others of muskets, others from the sound of bells.

Were these the only experiments (says Dr. G.), on the subject that had ever been made, I should not regard them sufficiently extensive to justify me in deducing from them even an *approximative* rule. But as they have been made with great care, I may at least venture to present a rule, which, while it includes with only slight discrepancies all the preceding results, is simple enough to be easily recollected by practical men; and may, perhaps, be employed in our own climate. It is this:

At the temperature of freezing 33°, the velocity of sound is 1100 feet per second.

For lower temperatures deduct } half a
For higher temperatures add } foot.
From the 1100 } for every degree of
to the 1100 }

difference from 33° on Fahr. therm., the result will show the velocity of sound, very nearly, at all such temperatures.

Thus, at the temperature of 50°, the velocity of sound is 1100 × ½ (50—33) = 1108½ feet.

At temperature 60°, it is 1100 + ½ (60—33) = 1113½ feet, agreeing with the experimental result quite within the limits of a practical rule.

The above practical rule, so far as it may be entitled to confidence, may be useful 1st, to the military man, in determining the distance of an enemy's camp, of a fortress, a battery, &c.; 2nd, to the sailor, in determining the distance of another ship, &c.; 3rd, to the land-surveyor in ascertaining the length of base lines, &c. in conducting the survey of a lordship or county; 4th, to the philosophic observer, in appreciating the distances of thunder clouds during a storm. Yet in either of these applications the rule must be regarded as *approximative* only; because few practical men can be expected to possess a time-measurer for less intervals than *tenths* of seconds (if, indeed, so small): and an error of a tenth of a second, will occasion a mistake of from 37 to 40 yards in the estimate of the distance. Beyond this, however, the error need scarcely ever extend; because a mean of five or six careful experiments will usually give the interval to a degree of correctness far within the limits just specified. Indeed, an error of from 30 to 40 yards in a distance of three or four miles, will, on most occasions, where such approximative estimates are required, be of but small consequence. When the distance exceeds four miles, this method of approximating to it can only be employed under favourable circumstances of a very quiescent atmosphere, &c.

Combining the results of experiments here recorded with those which have been formerly deduced by Derham and others, we may, I think, conclude unhesitatingly:

1st, That sound moves *uniformly*; at least, in a horizontal direction, or one that does not deviate greatly from horizontality.

2nd, That the difference in intensity of a sound makes no appreciable difference in its velocity.*

3rd, Nor, consequently, does a difference in the instrument from which the sound is emitted.

4th, That wind greatly affects sound in point of *intensity*; and that it affects it also in point of *velocity*.

5th, That when the direction of the wind *concurs* with that of the sound, the *sum* of their separate velocities gives the *apparent* velocity of sound; when the direction of the wind *opposes* that of the sound, the *difference* of the separate velocities must be taken.

6th, That in the case of echoes, the velocity of the *reflected* sound is the same as that of the *direct* sound.

7th, That, therefore, distances may frequently be measured by means of echoes.

8th, That an augmentation of temperature occasions an augmentation of the velocity of sound, and *vice versâ*.—[See Newton's *Principia*, lib. 2, prop. 50. Parkinson's Mechanics, vol. ii. p. 148.]

THE CUBE ROOT.

North Leith, June 14, 1824.

GENTLEMEN;—In the 38th Number of your valuable Magazine, there are given two rules for extracting the cube root. They are, however, the same in principle, and seem to have been modelled from Mr. Ingram's rule, given in his edition of Melrose's Arithmetic, and in his Appendix to Dr. Hutton's. It is *possible* your correspondents may not have seen the works alluded to, and in that case they have all the merit that an original inventor can have. Mr. Ingram has been more than once referred to in your pages for the management of circulating decimals, and I think that in the present instance, you cannot do better than again refer your readers to Ingram's Melrose for an easy mode of extracting the cube root, which they will find, upon examination, to be the same with that of your two correspondents.

T. S.

* The cooperation of the notes in a tune, notwithstanding the difference in their intensity, being uninterrupted when heard at a distance, furnishes an elegant and decisive confirmation of this proposition.

DAMP WALLS.

To the Editors of the Mechanic's Magazine.

May 14, 1824.

GENTLEMEN;—Observing in No. 30 of the Mechanic's Magazine "A remedy for drying damp walls," I shall be much obliged for a little further information from any of your correspondents on the subject. I have a room on the ground-floor which I occupy as a sleeping-room, but which is so exceedingly damp, that any thing of either iron or steel being left in it for a short time, becomes covered with rust, and neither colouring nor paper will adhere to the walls. It is well ventilated, and the exterior of the walls appears tolerably dry; there are also cellars beneath it, in which there is a free draft of air; yet although I have been at some expense in endeavouring to correct the dampness, I have not succeeded. I conceive the sulphuric acid would, in a great measure, have the desired effect, and I wish to ascertain whether it is not the "oil of vitriol" sold at the oil and druggists' shops?* how much is necessary for a square yard? and in what manner is it to be applied?—as I conceive it would, in an undiluted state, destroy a hair-brush in a very short space of time?

J. B.

INQUIRIES.

No. 40.—OIL FOR WATCH-MAKERS.

GENTLEMEN;—In the practice of my business as a clock and watch-maker, I have often been greatly perplexed for want of genuine oil: that which I have procured from our country druggists, has, to my very great loss, turned out so bad as to stop or spoil the going of my watches; sometimes by congealing, and at others by drying and exposing the work to undue friction. If any of your correspondents can tell where genuine oil can be purchased, or can instruct us how to fine the oil we buy in the country, so as to make it fit for our purposes, it would be conferring a great favour on many who have been much perplexed by

* It is the same; but rarely procured even from the druggists' shops in a pure state.—EDIT.

the use of the adulterated article. I should be also obliged to any of your correspondents to explain, why of 20 watches cleaned at the same time, with the same oil, 19 will go free and well twelve months, and the twentieth stop in a month or two. I have found this the case sometimes, and have been at a loss to account for it. J. S. B.

[The oil considered best for the purposes of the watch-maker is the expressed olive oil, which can very seldom be procured without considerable impurities, some accidental, and others designedly produced by an intermixture of inferior vegetable oils. Mr. E. Walker has given in the Philosophical Magazine the following process for purifying it. Can any of our correspondents prescribe a better,—one especially that can be accomplished in less time?

"Put a quantity of the best olive-oil into a phial, with two or three times as much water, so that the phial may be about half full. Shake the phial briskly for a little time, turn the cork downwards, and let most part of the water flow out between the side of the cork and the neck of the phial. Thus the oil must be washed five or six times. After the last quantity of water has been drawn off, what remains is a mixture of water, oil, and mucilage. To separate these from each other, put the phial into hot water for three or four minutes, and most part of the water will fall to the bottom, which must be drawn off as before. The oil must then be poured into a smaller phial, which being nearly full, must be well corked, set in a cool place, and suffered to stand undisturbed for three or four months, or until all the water shall have subsided with the mucilage on the top of it, and the oil perfectly transparent, swimming upon the top of the mucilage. When time has thus completed the operation, the pure oil must be poured off into very small phials, and kept in a cool place, well corked to preserve it from the air."

EDIT.]

No. 41.—CAN YOU DRAW A MILE OF STRING?

Chatham Barracks, May 12, 1824.

GENTLEMEN;—A question has been lately introduced here, which, although often attempted, has never been answered, nor, I believe, properly elucidated. The matter in dispute is merely this:—Suppose a string, twine, or cord, equal to a mile in length, be coiled up, and laid down on a piece of ground (as level a piece of ground as can conveniently be had for the sake of the experiment) on which a person can go in a straight line a mile; is it possible that any one man can, by his own physical power, take one end, and thereby draw the whole mile of string out of the coil, and place it in a straight direction. Or, to simplify the case, by stating it another way, can any man, pulling this string at one end, cause any visible movement at the other,—supposing it to be laid down on the ground in a straight direction, and reaching a mile?

It is considered that the weight of air must considerably affect the operation; but we are unable to calculate that. Perhaps by giving publicity to this, some of your ingenious correspondents would gladly solve the question.

Your constant reader.—E. Q.

[The best, perhaps the only way to settle this question, is to make the experiment. Soldiers in garrison may be worse employed.—EDIT.]

BALTIMORE FLOUR MILL.

Baltimore is celebrated for the fineness of its flour, the superiority of which arises from the perfection to which they have arrived in the machinery by which it is manufactured. I have recently visited a mill driven by steam, in which manual labour is so completely excluded, that the sailor who delivers the grain at the wharf is the last person who applies his hand to it, till it descends into the barrel in the shape of superfine flour. It is difficult to convey a proper idea of machinery without the aid of drawings, but I trust you will be able to comprehend the following rude outline of the process. A covered trough, which projects from the mill to the edge of the wharf, receives the grain as it is emptied from the vessel; within this trough is an axle, revolving longitudinally, around which are thin pieces of wood projecting into the trough; and continued along in a spiral line. As the revolution of the screw of Archimedes raises water, so this axle, by revolving among the grain, forces it backward in a regular current from the wharf to the mill. The grain, on reaching the inner end of this trough, is received into a succession of little tin buckets, which are strung upon an endless belt, revolving on two wheels, the higher of which is in the garret floor. As these buckets turn over the upper wheel, they empty their contents into a box, from which the grain is conveyed to the fanners, where it is thoroughly cleaned. From the fanners it is conducted into the hoppers, in the floor below; here eight pairs of stones are kept constantly at work. From the stones the flour descends into a long wooden trough, similar to that into which the grain was first thrown; and another spiral screw, revolving here, urges it gradually forward to another series of buckets, which carry it to an upper story, and discharge it under a machine for cooling it. This consists of a spindle revolving perpendicularly, with an horizontal shaft crossing it near the floor, in the under part of which are teeth formed of thin slips of wood, which nearly touch the floor, and which are so disposed in relation to each other, that while they stir the flour round, they at the same time convey it inwards to the centre. The flour is thus spread thinly over the floor, and as the teeth revolve among it, it describes circles successively smaller and smaller, until it falls through an opening in the story below. Here are three bolting cylinders, producing the various degrees of common, fine, and superfine flour; and from them it is finally received into barrels, ready for inspection and shipping. This mill manufactures with ease a thousand bushels a day, and the flour which it produces always commands an advance on the average market price." — *Duncan's Travels in America.*

METHOD OF CLEANING SILKS, WOOLLENS, AND COTTONS, WITHOUT DAMAGE TO THEIR TEXTURE AND COLOUR.

Grate raw potatoes to a fine pulp in clean water, and pass the liquid matter through a coarse sieve, into another vessel of water; let the mixture stand till the fine white particles of the potatoes are precipitated; then pour the mucilaginous liquor from the fecula, and preserve the liquor for use. The article to be cleaned should then be laid upon a linen cloth on a table, and having provided a clean sponge, dip it into the potatoe liquor, and apply it to the article to be cleaned, till the dirt is perfectly separated; then wash it in clean water several times. Two middle-sized potatoes will be enough for a pint of water.

The coarse pulp which does not pass through the sieve is of great use in cleaning worsted curtains, tapestry, carpets, and other coarse goods. The mucilaginous liquor will clean all sorts of silk, cotton, or woollen goods, without hurting or spoiling the colour; it may be also used in cleaning oil-paintings, or furniture that is soiled. Dirtied painted wainscots may be cleaned by wetting a sponge in the liquor, then dipping it in a little fine clean sand, and afterwards rubbing the wainscot with it.—*Economist.*

AN INFALLIBLE BAROMETER.

Put two drachms of pure nitre and half a drachm of chloride of ammonia, reduced to powder, into two ounces of spirit of wine, or pure alcohol, and place this mixture in a glass tube, ten inches long and eight lines in diameter, the upper extremity of which must be covered with a piece of skin or bladder, pierced with small holes. If the weather is to be fine, the solid matters remain at the bottom of the tube, and the alcohol is as transparent as usual. If rain is to fall in a short time, some of the solid particles rise and fall in the alcohol, which becomes somewhat thick and troubled.—When a storm, a tempest, or even a squall is about to come on, all the solid matters rise from the bottom of the tube, and form a crust on the surface of the alcohol, which appears in a state of fermentation. These appearances take place 24 hours before the tempest comes; and the point of the horizon from which it is to blow is indicated by the particles gathering most on the side of the tubes opposite to that part whence the wind is to come.—*Chemist.*

NEW PATENTS.

To James Cook, of Birmingham, Warwickshire, gun-maker, for certain improvements in the method of making and constructing locks for guns, pistols, and other fire-arms.—20th May—6 months.

TO CORRESPONDENTS.

We are obliged (owing to absence from town) to defer till next week, acknowledgments to a numerous list of correspondents.

Communications (post paid) to be addressed to the Editors, at

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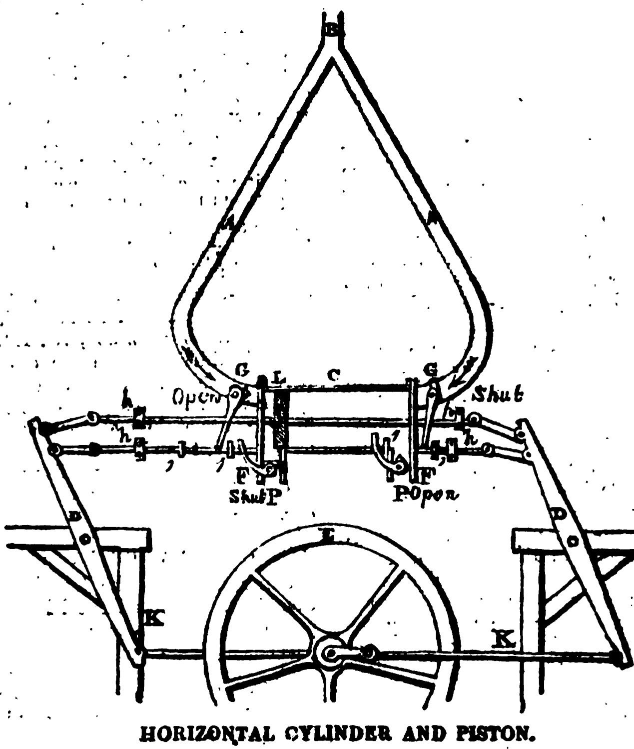
Museum, Register, Journal, & Gazette.

LEARNING, that cobweb of the brain,
Profuse, erroneous, and vain;
A train of knowledge, as replete
As others are with fraud and cheat;
An Art t' encumber sense and wit,
And render both for nothing fit;
A cheat, that *Scholars* put upon
Other men's reason and their own:
A font of error to ensconce
Absurdity and ignorance;
That renders all the avenues
To Truth, impervious and abstruse.—*Butler's Hudibras.*

No. 47.] SATURDAY, JULY 17, 1824. [Price 3d.



HORIZONTAL CYLINDER AND PISTON.

GENTLEMEN;—Under the protection of your invitation to correspondents in No. 2, I venture to send you a rough sketch of what I term an Horizontal Cylinder and Piston, to the invention of which I was led by seeing in No. 30 the design of an upright one, recommended as calculated to answer the purpose of "A Miller in the Mountains."

R. M'VOY.

Description of the Engraving.

B is a pipe to conduct the water from the height; A A, two branch pipes to conduct the water to each end of the cylinder C; D D, lever beams coupled to the piston, crank, and cock-rods, in the same manner as is customary with engineers; E, a fly-wheel, with cranks on each side for the rods K K to be applied; F F, two cocks to empty the cylinder C alternately, G G, two cocks to admit the water alternately; *h h h h*, collars to keep the rods in their places; I, piston; 1 1 1 1 1, nobs on the opening and shutting rods; 2 2, two guards to direct the water to the piston, and to give time for the cock F to close; P P, waste pipes.

Suppose the cock G to have performed its office by admitting the water, and that the piston is driven to L, then 1 opens G cock, on the left end of the cylinder, to admit the water, and shuts F cock left hand, and opens E cock, right hand.

[Captain Vivian's invention for the same purpose, to which we alluded p. 271, and of which we propose shortly to give a description, is somewhat different. We should be glad to know from Mr. M'Voy whether his improvement has been reduced to practice?—EDIT.]

MONUMENT TO MR. WATT.

Public meetings have been held at Manchester and Edinburgh in aid of the subscription opened in London for erecting a monument to the memory of James Watt. Many respectable individuals in both these places have expressed a wish that each city should have its own monument; and in Edinburgh, at least, there is every probability that a separate one will be erected. One of the arguments made use of by the *modern Athenians* against co-operating in the London subscription, must be allowed to have considerable weight. The metropolitan monument is proposed to be erected either in the cathedral church of St. Paul, or in the collegiate church of St. Peter, Westminster; and should the latter be preferred, in consequence of the fees which are now exacted for admission into that repository of our illustrious dead, the monument will be literally locked up from all but the opulent and the very curious; yet we are told that one great object of this tribute to James Watt is, to hold forth to the whole community, and to the industrious classes especially, a memorable example of the honours that await those who contribute by the efforts of their ingenuity to the public weal! Surely the Edinburgh people are right, in contending that a monument for such a purpose should be placed in the most public situation possible, that all eyes may behold it, and every mind catch the sentiment which it is meant to inspire.

Mr. T. E. Taylor mentioned, incidentally, at the Manchester meeting, an interesting circumstance respecting a descendant of the inventor of the Spinning Jenny. "He had recently learnt that his grand-daughter was now a pauper! He did not intend at that time to suggest any proceeding on the subject; he wished that it was only necessary that the fact should be stated in order to lead to the adoption of some means of at least alleviating the wretchedness of her situation." Can this refer to a grand-daughter of Brown, who, according to a correspondent in a former Number (p. 256, vol. II), is himself still living in some obscure part of London? We trust that the public will not remain much longer in ignorance of the real circumstances of a family, to an individual of which it owes so much. The English public is not an ungrateful or ungenerous one.

COMBINATION LAWS.

GENTLEMEN;—The fact that the Combination Laws Repeal Bill was passed during the late session of parliament, does not seem to be generally known; such, however, is the fact The following case grows out of the repeal, and, in my opinion, illustrates its beneficial tendency: About a fortnight ago, the weavers of a power-loom factory, near Stockport, left their employ, because the master discontinued a bounty of 1s. per month, which he had been in the custom of paying to those weavers who performed an extra quantity of work. On the master's application to a magistrate, several of them were sent to prison for combining; but they were dismissed the next day, when the magistrate found that, according to law, he had sent them to the wrong shop. When it was fully ascertained that they might legally either combine against reductions of wages or increase of labour, they and their master soon agreed upon terms, and they began to work at 11*s.* instead of 14*s.* bounty. As other mistakes may occur, unless the press make the fact of the repeal more generally known, I have sent you this notice of the present with that view.

I am, Gentlemen,
Your obedient servant,
M. M.

WATER-PROOF CLOTH.

We mentioned in an early Number of our work (Vol. I, p. 56) that a chemist of Glasgow (Mr. Charles Macintosh) had succeeded in rendering woollen, silk, or cotton-cloth water-proof, by means of a solution of caoutchouc in mineral oil. For the following more precise specification of the process, we are indebted to the Glasgow Mechanic's Magazine. Before stating it, however, it may be proper to mention, for the information of some portion of our readers, that caoutchouc, or, as it is more generally termed, Indian rubber, is procured in South America, and in the East Indies, from certain trees, which, on holes being made in them, give out a milky substance, which, as would appear from the researches of the French chemist, Fourcroy, combines with oxygen when exposed to the atmosphere, and assumes the solid form. For the purposes of commerce, it is commonly put into the shape of bottles, by spreading a thin coating of the milky substance over a clay mould, and drying this coating in smoke, from which it derives its black colour (for it is naturally white), and when dry, putting above this, in like manner, such a number of coatings as will produce the requisite degree of thickness.

The singular qualities of caoutchouc, its softness, its elasticity, joined to its power of resisting water, have long pointed it out as a likely means of producing flexible water-proof fabrics, for cloaks, shoes, hats, and the like. For this purpose, the great object has been, to find a solvent of it, which, upon evaporation, will leave the caoutchouc with the same qualities which it possessed before the solution, just as water dissolves starch, admits of the solution being spread on cloth, or being impregnated in it, and dries, leaving the starch unchanged in its qualities.

Now, three such solutions have been proposed at different times. The first was sulphuric ether, which, though it does affect the solution, yet, as it must be pure, and as it is exceedingly expensive, is out of the question for common purposes. The second solution proposed, was oil of turpentine, which, however, was found so difficult to dry, that it has been abandoned. The third was rectified coal-oil, or naphtha, as it is called; this oil is a more powerful solvent than the former, and it dries more readily, but still so imperfectly as to leave the caoutchouc clammy, and too devoid of firmness to bear any of the fatigues of wear.

Such was the progress that had been made previous to the invention which is the more immediate subject of this notice.

Mr. Macintosh's process is exceedingly simple. The caoutchouc is put between two plies of cloth, which it cements so completely, that when the cloth is not thick, and both plies the same, it would readily be taken for a single ply. For this purpose, two appropriate pieces of cloth are selected, one for the outside, and the other for the lining. These are stretched on tables, or frames, by the common means employed in calico-printing processes. A thin coating of the caouthouc, in a solution of naphtha, is put on each of them, and is allowed to dry. A second is then put on each, and allowed to dry, and likewise, if necessary, a third and a fourth. At last, a coating is put on one of the plies, and the other ply (with varnished side to varnished side) is put above it, and spread upon it evenly. It is then dried in a stove, to remove the smell of the oil. Lastly, it is smoothed, by passing it through a calender.

This process greatly strengthens the cloth, without materially altering its appearance. The different plies of cloth may be either of the same kind, or different; woollen cloth to woollen cloth; cotton cloth to cotton cloth; silk to silk; woollen cloth to cotton cloth; or, cotton cloth to silk, &c.

BRUNTON'S COMPENDIUM OF MECHANICS.

We recommend to all who have ever felt the want of a cheap text-book for operative mechanics, a little volume under the above title, compiled by a mechanic of Glasgow, and modestly dedicated to his brethren of that city. It comprehends a great variety of most useful practical rules and tables, derived from the best sources, with examples of each rule, calculated in common decimal arithmetic, so as to be universally intelligible. We remarked, in the course of our perusal, some theoretical inaccuracies, and also a few questionable statements of matters of fact, particularly where the author treats of the motion, resistance, and effect of machines. But upon the whole, the work does great credit to Mr. Brunton's industry, intelligence, and discrimination. We subjoin, as a fair specimen of the work, a compendious, yet clear statement of the rules for finding the centrifugal force in any revolving body.

A body moving round a central point inclines to fly off in a straight line, from the first impulse of motion; the force which causes it to leave that line, or move in a circle round the point, is called the Centripetal; and the resistance which it affords, the Centrifugal force; or, in other words, when a body revolves round its centre of motion, the centrifugal force is that power or tendency which the body has to burst or fly asunder; and the centripetal force is that power which keeps the body from bursting or flying asunder.

It is evident from the last remark, that the greater the velocity, the greater will be the centrifugal force and from the 5th remark, the greater the mass, the greater the momentum; therefore, as is the weight and velocity of the revolving body, so is the centrifugal force.

Suppose two fly-wheels of the same weight, one of them 12 feet diameter, and revolving in 8 seconds; what must be the diameter of the other, when it revolves in 3 seconds?

The diameter and velocity of the first must be equal to the diameter and velocity of the second; therefore $8^2 : 12 :: 3^2$ is to the diameter $= \frac{12 \times 3^2}{8^2} = \frac{108}{64} =$ 1·6875 foot, the diameter of the second fly-wheel at the circle of percussion.

Again, suppose two fly-wheels of the same diameter, the one revolving in 3 seconds, and the other in 8 seconds; what will be the difference of their weights?

As $3^2 : 8^2$ so is the weight of the one to the weight of the other.

$\frac{8^2}{3^2} = \frac{64}{9} = 7\frac{1}{9}$, their weights will be to each other as $7\frac{1}{9}$ is to 1; and by knowing the weight of the second, and dividing it by $7\frac{1}{9}$, will give the weight of the first.

In the two preceding Examples, weight and velocity are taken separately.—The following Examples give the centrifugal force, when both weight and velocity are used.

Required the centrifugal force of a fly-wheel, diameter 16 feet, velocity 80 revolutions per minute, and weight $3\frac{1}{2}$ tons?

3·1416 = circumference of a circle, the diameter 1.

16 feet = space a body falls through in 1 second of time.

$\cdot 83\dot{3}$ = time of one revolution.

$$\frac{16 \times 3{\cdot}1416^2}{16 \times \cdot 83\dot{3}^2} = \frac{157{\cdot}9136}{11{\cdot}1122} = 14{\cdot}21$$

times the weight in tons, the weight being $3\frac{1}{2}$ tons; therefore $3{\cdot}5 \times 14{\cdot}21 = 49{\cdot}73$ tons, the centrifugal force.

The stones on which they grind table-knives at Sheffield, are about 44 inches diameter, and weigh about half a ton; the velocity of the circumference is at the rate of 1250 yards in a minute, equal to 326 revolutions; required the centrifugal force?

$22^2 \times 2 = 968$, the square root of which is 31·1 inches, or 2·59 feet, the diameter of the circle of gyration.

As 326 : 60 :: 1 : ·184 seconds, the time of one revolution.

$$\frac{2{\cdot}59 \times 3{\cdot}1416^2}{16 \times 184^2} = \frac{25{\cdot}5822}{{\cdot}54169} = 47{\cdot}18$$

times the weight of the stone: the stone is ·5 ton, therefore 47·18 × ·5 = 23½ tons centrifugal force. BANKS.

A FEW FACTS TO CONFUTE A "NOTABLE THEORY."

GENTLEMEN;—On seeing the communication of "Minimus," (p. 235, Vol. II), I immediately determined to send you my opinion on the subject, as I have, for some time past, regarded the theory alluded to as entirely incorrect. I shall, therefore, proceed, without further ceremony, to lay down five undoubted facts, and from them prove its fallacy.

1. Every hollow body has a *free* communication between the internal and external air; and also *every porous* body contains air of the *same* density as that which *surrounds* it; therefore, the external air cannot press on the *surface* of such bodies. For if the body be brought from air of extreme density to air of extreme rarity, the internal air will always keep pace with the external; therefore, no external pressure can be the consequence of such change.

2. The atmosphere has the property of *always* endeavouring to *keep in equilibrio*, which the succeeding experiments will sufficiently demonstrate.

3. In order to cause a pressure of the air on the surface of a hollow body, the internal air must be *rarer;* it must, also, have *no communication* with the external air during the pressure; if there were any (on account of the above property of the air), the external air would immediately enter; the pressure would then cease, being only caused by the efforts of the atmosphere to regain its equilibrium, and therefore, in proportion to the *rarity* of the one and the *density* of the other, so will be the force of the pressure. The well-known pneumatical experiment of the "two brass hemispheres," is a proof of the truth of what I have stated. It may, also, be proved thus:—procure a thin *square* phial; if the mouth of it be accurately stopped, leaving only a *very small aperture,* and in that state the air be exhausted from the receiver (as it cannot be done immediately), it will have time to escape out of the bottle through the small aperture; if the air be now let *suddenly* into the receiver, it cannot enter the phial so quickly; therefore, the external air will press on the sides of it, and shiver it to pieces. If the phial were *round,* it would resist the pressure better than a *square* one, on account of its opposing an *arched* surface; nevertheless, the pressure would be equally as forcible. This is the reason why the receiver is made *round,* and with an *arched* top.

4. To cause the *internal* air of a hollow body to *expand,* or *press outwards,* the *external* air must be rarer; also, as in the former case, there must be no communication with the surrounding air during the expansion or pressure; and in proportion to the density of the internal and the rarity of the external air, so will be the force of the expansion. If the phial, filled with common air, be completely stopped so as to be rendered air-tight, and in that state the air exhausted from around it, the pressure of the *external* air being then taken away, the expanding force of the *internal* air, by endeavouring to restore the equilibrium, would press against the inside of the phial; and if the phial be not made strong enough to resist the force, it would be broken to pieces.

5. The air in these experiments, by its property of always trying to keep its equilibrium, *presses in every direction,* and there is not the least doubt but that it does so *equally,* as every side of the phial will be broken if they are all made of the same strength.

I shall now proceed to the confutation of the assertion, that the atmosphere presses on our bodies to the extent of more than 30,000 lbs. The tmosphere has *always* a *free* access to *every part* of the human body by means of respiration, or breathing, and through the pores of the skin, by which means the changes in the atmosphere *always* affect the body in a greater or less degree. The body, then, always contains air of the same quality and density as that by which it is surrounded. I have already proved, that the atmosphere cannot press on the surface of bodies that admit a free access of it in every part, as is evidently the case with the human body. If the body of a man were *hollow*, and the internal air exhausted to a *complete vacuum*, the atmosphere would, no doubt, press on it to the extent in question; in such a case it must have no communication with it.

Supposing that such an enormous weight did actually press on our bodies, how greatly must the internal air be *condensed* to withstand the pressure! If we suppose this, there must be no communication with the external air any more than in the former case; if there were any (on account of the property of the air to keep itself in equilibrio, as I said before), the internal and external air would immediately become of the same density, in which case there could be no pressure.

The last proof I shall bring forward, is in the case of our "poor aëronauts." If there were no communication between the air in our bodies and the atmosphere, when a man ascends to a considerable height, would not the expansion of the air in his body cause it to swell, and at length to burst? It is evident, he would not be pressed upwards, so as to have his brains bumped out against the bottom of his balloon, as your correspondent seems to apprehend.

Having thus, I trust, proved the fallacy of the theory altogether,

I remain, Gentlemen,

Yours most respectfully,

J. E. Coombs.

SILK-TWISTING MACHINERY.

To the Editors of the Mechanic's Magazine.

Harpurhey, April, 1824.

Gentlemen;—In a village near Manchester there is a machine used for the purpose of twisting silk. By inserting the following calculations respecting this machine in your valuable miscellany, you will oblige

Yours, &c.

Joseph Hall.

The circumference of the large pulley which communicates motion to the machine by means of a strap, is 83 inches; this pulley makes 27 revolutions per minute, and turns another pulley 28 inches in circumference, on the axis of which is a third pulley, equal in circumference to the first; this third turns a fourth, 24 inches in circumference, which is fixed to the end of the drum's axis. The circumference of the drum is 23 inches, which turns a small pulley 2¾ inches in circumference, which is fixed to the spindle, and which is turned by means of a small cord. Now,

$$\frac{83\times83\times23\times27}{28\times24\times2\frac{3}{4}\times1}=\frac{17112276}{7392}=2305$$

revolutions, which the spindle makes in one minute. Again, $\frac{83\times83\times27}{28\times24\times1}$ $=276$ (omitting fractions) revolutions which the drum makes in one minute. On the drum's axis is fixed a wheel, 12½ inches in circumference, which, by means of a strap, turns another wheel 48 inches in circumference, on the axis of which is a wheel containing 23 teeth, which turns another wheel of 84 teeth, on the axis of which is a third wheel of 32 teeth, which turns a fourth wheel of 60 teeth; on the axis of this last, is a worm which turns a fifth wheel containing 11 teeth, on the axis of which is another worm that turns a sixth wheel, which contains 97 teeth; this last turns a seventh wheel, which regulates the motion of the thread upon the bobbin. Again,

$$\frac{12\frac{1}{2}\times23\times32\times1\times1\times276}{48\times84\times60\times11\times97\times1}=\frac{5078400}{469480480}$$

by dividing the denominator of this fraction by the numerator, the quotient is 90 minutes, the time in which the wheel containing 97 makes one revolution. When the steam-engine which turns the machinery moves regularly, this wheel serves as a time-piece, one tooth of which may be called a minute, because $\frac{90}{97}$ of a minute is $55\frac{65}{97}$ seconds. The effect produced by the combination of wheels is astonishing. Here is a wheel nearly in contact with the spindle, which takes 90 minutes to complete one revolution, while the spindle makes 207450 in the same time!

Similar calculations inserted in your valuable miscellany, would teach the young mechanic the true scientific method of estimating the powers of machinery, which is too often unknown to men of good abilities who are constructors of machines.

AUDIBLE SAND GLASS.

Upper Norton-street, June 23, 1824.

GENTLEMEN;—In the 43rd Number of your interesting Magazine, is an ingenious description of what is called an "*Audible Sand Glass*;" it appears to me, however, perfectly impracticable according to Mr. H.'s plan. He states, "The whole must be so placed, that when the inverted cone is filled with a sufficient quantity of sand to run for the requisite number of hours, the weight shall be balanced at the end of the lever, and *remain so* until the *whole* of the sand being run out, the end of the lever on which the weight rests, becomes the heavier, and lowers," &c. &c. I should like to ask the ingenious Mr. H. *how* this is to be done? Suppose the weight of sand to be one ounce, how is it possible that the lever could be balanced, having that weight attached, and *remain so* until the last grain should be run out? According to Mr. H., the lever would be in equilibrium just before the last sand would run out; at the beginning of the experiment the sand glass would be one ounce heavier; would not that additional weight raise the ball?

DUKE HUMPHREY.

[Good, my Lord Duke! But your objection is easily obviated. A little stop under that arm of the lever to which the sand-vessel is attached, prevents it from being weighed down, but not from being raised at the moment the escape of the sand makes it the lighter.—EDIT.]

MR. CAREY's IRON KNEE FOR SHIPS.

Rotherhithe, July 6, 1824.

GENTLEMEN;—In your 45th No. I perceive that Mr. E. Carey, of Bristol, has sent you a drawing of his improved iron knee for fastening a ship's side, instead of the old plan of two separate knees, called lodging knees.

Now, as your correspondent is without doubt an ingenious man, he will not be offended by my asking him the following questions:—

1. Whether the ends of the beams being cased with iron, would not induce dry-rot, already incident to the old plan, though ventilated in ways of which, under this method of fastening, they are incapable?

2. Whether he thinks the advantages he states to be gained by it, would not be counterbalanced by the additional cost, particularly as they could not always be got at a foreign port to be depended on?

3. How they are to be removed and replaced if defective?

As this is a subject in which I am deeply interested, I trust Mr. Carey will consider this, not as an attempt to deteriorate the merits of his invention, but as a fair and candid appeal to establish its utility.

Gentlemen, yours respectfully,

G. B.

TO CALCULATE THE POWER OF OVER-SHOT WATER-WHEELS.

The following rule for overshot water-wheels will be found much easier for calculation than the tedious method by trigonometry, given by your intelligent correspondent J. Y.

RULE. Multiply the constant number 6·465 by $\frac{1}{3}$, the number of buckets in the wheel, and the product by the number of ale gallons contained in one bucket, and the result will be equal to the effective weight or momentum of water on the loaded arch in lbs. avoirdupois.

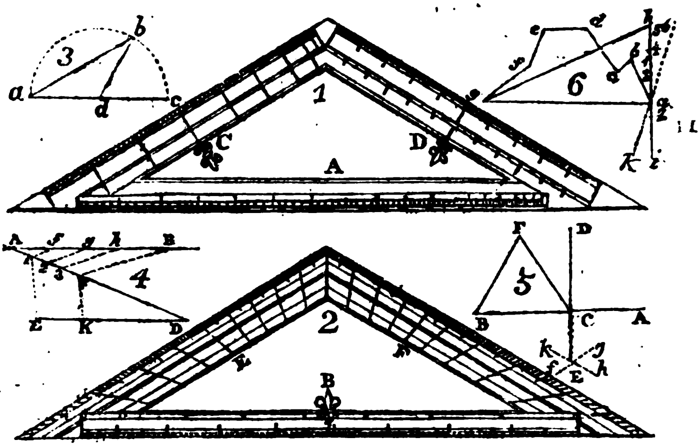
W. ANDREWS.

SPINNING MACHINES.

Two improved spinning machines have been recently introduced into America. One invented by a Mr. Wilkes Hyde, is called the *Vertical Spinner*; and it is said, that a girl, by means of it, may spin as much in one day as any other person can, with other wheels, spin in four days: by the other, which is the invention of a Mr. Gilbert Brewster, the *spinning, even of the finest wools*, is so facilitated, that the expense is reduced to *one cent per pound*.

THE PANMETRON, OR, UNIVERSAL MEASURE.

Invented by MR. JAMES JORDAN, *of Downpatrick.*



[The following account is copied, with a little alteration and abridgment, from Mr. Jordan's description, a copy of which has been obligingly transmitted to us by Archibald Hamilton Rowan, Esq., who describes the inventor to be "an excellent practical workman," and of a most "inquiring turn of mind." The invention appears to us ingenious, and calculated to be of very considerable utility. The Royal Society of Dublin, as a mark of their approbation of it, have resolved, that a Panmetron of silver, containing a suitable inscription, shall be presented to Mr. Jordan.—EDIT.]

This instrument is an isosceles triangle, whose legs embrace an angle of 120 degrees, and it is thus constructed:—With the length of one of the equal sides, as a radius, describe the semicircle (fig. 3) *a b c*; through the center draw the line (a diameter) *a d c*; make *c b* equal *a d* or *d c*, and draw the line *d b*; then join the points *a* and *b* by the line *a b*; and then will the triangle *a d b* be the true figure of the Panmetron.

In our illustrative engravings of the instrument, the numerals and more minute divisions are necessarily left out.

Fig. 1.—The leg C is graduated into a line of natural sines, and a line of versed sines. The leg D is graduated into two lines of equal parts, and the decimals of a foot; the outer lines of the legs D and C act together in the same manner as the logarithm lines of numbers and sines on Gunter's scale.

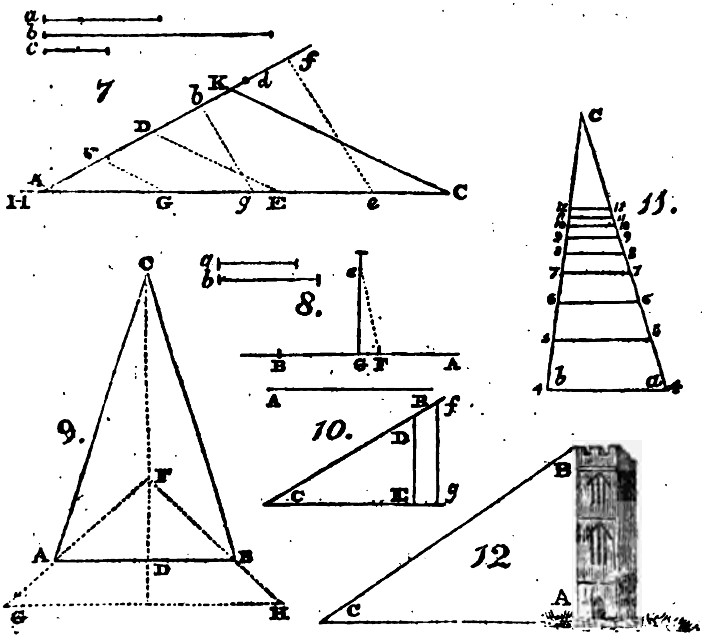
The base A is graduated into a line of tangents, and a polygon line: the line of tangents proceeds as far as 45, and then turns back by the inside line; these are the co-tangents of each other, and the intermediate divisions answer for both. This line answers the same purpose as the tangent logarithm line on Gunter's scale, and acts with the lines of sines and equal parts on the legs C and D.

Opposite the divisions, on the polygon line, are numbers representing the angles contained at the center of each of the polygons.

Fig. 2.—The two legs, E and F, are graduated into the degrees of a semicircle, whose center is in the middle of the base B: these legs, so graduated, construct, or find the quantity, of angles to any number of degrees, and act in the same manner as the semicircle or circular protractor.

The base B is graduated into a line of chords and a line of rhombs.

The Metron performs the part of the parallel rule, protractor, plain and logarithm scales, and also of com-



passes, as it draws parallel lines, raises perpendiculars, and divides lines, &c.—The following are a few operations to show its use:

I.—*To draw lines parallel.* Fig. 4.

Apply the base A of the Metron to the given line A B; then apply a rule or straight edge to either leg; keep the rule steady, slide the Metron along it, then will lines drawn by the base be parallel to the given line A B.

II.—*To draw a line perpendicular to a given line.* Fig. 5.

Apply the base of the Metron to the given line A B; apply the rule to either leg, keep the rule steady, turn the other leg C to it, and a line drawn by the line D will be perpendicular to the given line A B.

III.—*To bisect perpendicularly a given line,* A B. Fig. 5.

Apply the base A of the Metron to the given line A B, and rule (as before) to the leg D; keep steady the rule, and slide the Metron along it until the leg C touch the point B of the given line, and by the leg C draw an obscure line *g f*; again slide the Metron a little the contrary way, so as to cover the obscure line *g f*; then remove the rule to the leg C of the Metron, and slide it along the rule, until the leg D touch the point B of the given line, and by the leg D draw the obscure line *h k*, and where the lines *g f* and *h k* intersect at E, raise a perpendicular (by Prop. 2) as E C D, so will the line C D be perpendicular to the given line A B, and also bisect it.

IV.—*To divide a given line, as* A B, *into any required number of equal parts.* Fig. 4.

Suppose it is required to divide the given line A B into four equal parts: from the point A draw a line as C D, forming any angle with the given line at pleasure; then with the leg D of the Metron prick off any four equal divisions from the line of equal parts, as 1, 2, 3, 4; then draw the line B 4, and parallel to this line (by Prop. 1) draw lines from the points 3, 2, 1, as 3 *h*, 2 *g*, 1 *f*; and where these parallel lines cut the given line A B in *f*, *g*, *h*, are the points which divide the given line A B into four equal parts.

V.—*To divide a given line*, D E, *in the same proportion as the given line* D 1 *divided in the point* 4. Fig. 4.

Place the two given lines as C 1, D, E, forming any angle at pleasure, and draw the line 1 E; then parallel to this line (by Prop. 1) and from the point 4 draw 4 *k*, and *k* is the point which divides the line D E in the same proportion as the given divided line.

VI.—*Three lines given, as a, b, c, to find a fourth proportional line.* Fig. 7.

Draw the lines A B, A C, forming any angle at pleasure; then with the line of equal parts, or the leg D of the Metron, make A D equal the given line *a*, and also the lines A E, A F, equal *b* and *c*; join D E, and through F draw F G parallel (by Prop. 1) to D E; then will A G be the fourth proportional line.

In the same manner may a fourth proportional be found in numbers.

VII.—*To find a mean proportional line between the two given lines a and b.* Fig. 8.

Join *a* and *b* so as to make one right line, as A G B, and bisect it (by Prop. 3) in the point F, and from the point of contact or meeting of the two lines, erect the perpendicular G *e* (by Prop. 2), and from the point of bisection F, make F *e* (with the line of equal parts on the leg D of the Metron) equal to A F or F B; then will G *e* be the mean proportional line.

VIII.—*To construct an angle of any number of degrees from the given point* A, *in the right line* H C, *suppose* 30 *degrees.* Fig. 7.

Apply the base B of the Metron to the given line H C, with the centre of the base coinciding with the point A, from whence the desired angle is to rise, and mark the point opposite 30 degrees on either legs: join *d* A.

(To be concluded in our next.)

BALLOON SAFETY-HOOP.

George-street, Shoreditch,
July 5, 1824.

Gentlemen;—Your correspondent, "James Marsh," informs us, that my suggestion of the balloon safety-hoop has been attempted before; but I pledge my word, that I never heard of such a contrivance: if I had, I should not have communicated it to the world as emanating from myself.

I feel extremely obliged by that gentleman's description of the experiment of the brothers, Charles and Robert, because its effects are exactly what I anticipated, and prove that my ideas of the subject are correct.

He objects to the hoop as being inconveniently large; but I never intended that it should be made of one piece only, but in sections. Suppose, for instance, the circumference to be 90 feet, it would require 9 pieces, of 10 feet each, connected by the same number of brass tubes, each 12 inches long, so that the ends of each section would be inserted 6 inches into the tube, forming a strong hoop that might be put together and separated in a few minutes.

I hope shortly to have an opportunity of proving to the world, that the plan is quite practicable, and calculated, without any iconvenience, to ensure the safety of the aëronaut.

Yours respectfully
E. W.

MEASURING ROUND TIMBER.

Besse, July 8, 1824.

Gentlemen;—In the paper sent by me some time since, on measuring what is called "round timber," I endeavoured to show the fallacy of the common method in such a manner as that the most illiterate mechanic might understand it, and not continue to make use of one so very erroneous, without knowing it to be so, merely because it is the custom of the country. But I observe in the 44th Number of your Magazine, one of your correspondents, who signs himself J. M. has undertaken to defend that method in a very long letter, in which he has endeavoured to prove it to be as correct as any other method. Now, as this defence is likely to mislead many measurers who are not acquainted with mathematics, I beg leave to submit the following remarks on it:—After informing us of his being a country mechanic, &c. he says, "It is known that the circle contains more (more what?) than any other figure of the same circumference, and therequently that the *least* variation in the circumference of a figure from that of a circle, must cause the contents of such figure to be less than that of the circle." Now, all this is very true; and J. M. is very much mistaken, if he supposes me to be ignorant of it; but I will now prove, by an example, not what a "*little*" variation from a circle will do, but what a *great* one will, by giving the solid contents of a tree 40 feet long and 48 inches in circumference. Not considering it as a cylinder, but as having every section an ellipse, whose transverse diameter is 17 inches, and conjugate 13·3; its true contents will consequently be 49 feet 3 inches, while by the common rule they would be no more than 40 feet, making a difference of 9 feet 3 inches! The contents, by measuring it as a cylinder, are 50 feet 11 inches; the difference between which and 49 feet 3 inches, is only 1 foot 8 inches. From this example, it will be easily seen, that a small variation from a circle occasions but a very *small* difference between the cylindrical and elliptical measures. In the above example, the difference is but 1 foot 8 inches, where the variation from a circle is nearly 4 inches—a variation which, I will venture to affirm, no timber-measurer will find in one tree in a hundred; this sufficiently proves the error of J. M.'s assertions, that a small variation from the figure of a circle will be nearly (how much the reader will judge) equal to half the excess of the cylindrical measure above the customary!

In my letter, I merely endeavoured to prove that the common method of getting at the contents of round trees was false, and to show how to come at the actual quantity of timber in the tree; I did not seek to enumerate the advantages or disadvantages attending either of the methods, nor to show how much is fit to be used as timber after it is sawed, or how much is only fit for the fire—all which circumstances have nothing to do with the measuring of the total quantity.

But J. M., after he has disposed of one-half of the excess of the cylindrical measure above the customary, says, "Timber must be hewn to prepare it for sawing; and if this waste (the waste occasioned by hewing) be taken into the account, it is almost equal to the other half;" so that, after he has measured his timber, he sets the hewers to work to correct his errors by hewing off the "*excess!*" From this practice has arisen the saying (very common among those whom I styled "pretended measurers,") that, "after you have taken four slabs from a round tree, the remainder will measure as much as the whole did before it was cut."

The fallacy of this is too palpable to need any comment. Beside measuring timber, merely to ascertain its quantity, timber-measurers have very frequently to measure large trees for the purpose of calculating their weight; and if they have not a correct method of ascertaining that quantity, how is it possible for them to calculate their weight with any exactness? As an instance of this, I had some time since to calculate the weight of an oak 18 feet long and 149 inches in circumference. It was very nearly cylindrical, and, consequently, its solid content was 190 feet nearly; while, by the common rule, it would be no more than 148 feet 9 inches, making a difference of 41 feet 3 inches! What is to be done with this 41 feet 3 inches? Is it to be hewn off, and burnt after the tree is measured? or how are we to bring it into the account?

In conclusion, I beg to inform J. M. that I am not only a theorist in the art, but have had considerable practice, though *un jeune homme*, and, consequently, am as competent to judge of the merits of the two systems as he can be.—I am, Gentlemen,

Your most obedient servant,

MESURAGE.

MR. BENNETT'S IMPROVED PUMP-IRONS.

Lincoln, July 6, 1824.

GENTLEMEN;—The communication of "X. Y, *a Millwright*," respecting my improved pump-irons, gave me no small surprise. I was not conscious of having claimed any thing that was not my due; and notwithstanding the assertions of X. Y., I am still inclined to believe that "the thing," as he terms it, if not entirely new in principle, is so in its construction and adaptation to pumps in general. I am quite ignorant of the construction of the iron-work "attached to the pumps of the (late) water-works at London Bridge;" but from their magnitude and the power employed to work them, it strikes me very forcibly that the irons must necessarily have been very different from those I took "so much pains to describe in p. 200 of your Journal." The assertion of X. Y. that the "thing is common in most parts of the country where pumps of a large size are used," I do not perfectly understand. What does X. Y. mean by pumps of a large size? Does he mean those which are employed to raise a large quantity of water in a short time, and to which steam or other potent power is applied as the moving principle? If so, I would thank X. Y. to name any one, the iron-work of which is constructed exactly in the same manner as mine; and if it be within a day's ride of Lincoln, I will be at the trouble to ascertain the fact. I have been in several parts of England, and have seen several different kinds of pump-irons, but none on the same plan as those I have described; and the fact of their being immediately adopted by most of the plumbers here, and the approbation expressed by all who saw them, induced me to make them public through the medium of your Magazine, as a small return for the information I obtain by the candid communications of others. I shall be very happy to be put on any better method, and trust that X. Y. will not long delay his promised sketches of those *far superior* plans with which he is acquainted.

I remain, Gentlemen, yours, &c.

J. Bennett.

THE STEAM-SOLDERING MACHINE.

Gentlemen;—We have heard of motion produced by steam, of apartments heated by steam, victuals cooked by the same means, cloths washed and dried by steam, eggs hatched and chickens produced by steam; but till the discovery of your Soho correspondent, announced in your last No., no one could have thought of increasing the intensity of *flame* by steam; nay, so completely mistaken is the young goldsmith on this subject, that there is scarcely an old woman in the kingdom but knows that small quantities of water thrown on the fire to be immediately converted into steam, and to rise in an aeriform state, is the best of all possible methods for extinguishing the flames of a chimney on fire. R. M.

[The steam-soldering machine is not so absurd as our correspondent seems to think; neither is the idea of exciting fire by the steam of water, either new or modern. Children have often amused themselves with "bathing the cinder and burning the smoke," that is, throwing a live coal into a tub of water, and lighting the steam with a candle. We refer any sceptic, who has not seen that old instrument, the "Æolopile" used, to read the account of it in any of the Encyclopædias, the Juvenile and Metropolitan's excepted; and he will find, that the fact is as old as the days of the Saxons.—Edit.]

QUADRATURE OF THE CIRCLE.

Westminster, July 2, 1824.

Gentlemen;—However desirable it may be to many of your readers, that the observation of Q. Y., in your 44th Number, should be attended to, as far as practicable, I cannot but condemn any acrimonious remark, as tending to hurt the feelings of those contributors to whom your subscribers in general are highly indebted. It ought to be recollected, that it is almost as difficult to divest literary and scientific men of the terms applicable to the subject on which they are treating, as it is to those not initiated in the principles of any particular science to understand them.

In reply to Q. Y., I have to observe, that the error into which he has fallen, as well as others, concerning the quadrature of the circle, arises from an apparent misinterpretation of the word "*squaring*." To square, in this instance, does not signify to alter the *figure* of the *circle*, and make a square of it, as he seems to have done, but to determine the exact proportion between the diameter, or longest straight line that can be drawn across a circle, and the circumference, or line that forms the circle. The nearest proportions hitherto discovered are those stated by Mr. Bevan,* in a former Number. But these, though near enough for most practical purposes, are not *strictly correct*, and, consequently, the desire to ascertain, if possible, the *exact proportion*, has occupied the attention of the most profound mathematicians for ages, without success; and this is denominated *squaring the*

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* As 113 is to 355, so is the diameter to the circumference; or as 355 is to 113, so is the circumference to the diameter required: or the diameter, multiplied by 3·1416, gives the circumference, and the circumference, divided by 3·1416, gives the diameter.

circle. To convince your correspondent further, I will reverse his own proposition, and suppose 100 the contents of a square, whose side, of course, is the square-root thereof, and that he wishes to alter the figure of the said square, and make a circle of it,—what must the diameter be, so as to contain the identical 100 parts? If he attempts the solution of this question, I think he will discover the difficulty he is in, and that his error will be apparent. Nor do I admit it as an INDISPUTABLE FACT that half the circumference multiplied by half the diameter, gives the *exact area*. It may, perhaps, do so in cases of actual admeasurement, but certainly not where the circumference or diameter only is given, because the relative proportions not being mathematically correct, the result of any work depending thereon must be equally erroneous.

Permit me to add, I should not have thrust myself forward on this occasion in the face of so many abler correspondents, but that I thought it might meet the views of Q. Y. to be replied to by *one of us*.

I am, Gentlemen,
Your most obedient servant,
E. W. S.

THE PRISM.

Light — Colours.

In the butterfly time, in a fine shining day, with a hat lightly put upon the head to screen the eyes from the sun, place one angle of a prism a little below the eyes, and move it up and down, until you see all the colours of the rainbow. The butterflies within fifty yards and more, will be seen moving about, not in their apparent insect form, but as a vibrating, tremulous flame of perpendicular fire, which, by the movement of the prism, will be made to appear from two to four inches in length. The first time I saw it, which was many years ago, the thought instantly struck me of the possibility of those words of holy writ—"Who maketh his angels spirits, and his ministers a flaming fire."* I deduced the conclusion, that from what we see in the natural and visible world, we may form some idea of what may take place in the unseen world — even spirits to be clothed in all the colours of the rain-bow. Though this may be a butterfly idea, let us remember, it was from observing the changeability of colours in soap-bubbles, among other things, that Sir Isaac Newton was carried to that height to which he rose as a philosopher. This experiment is best made in a garden of flowers.

MONTIS.

June, 1824.

* Psalm civ. 4.

HAWKINS' STEAM-ENGINE WITHOUT A BOILER.

The American papers state, that a small vessel, the machinery of which, furnace and all, occupied three feet in length, and two and a half in width, and without a boiler, was witnessed on the 10th of May, at Philadelphia, driving a common ferry-boat, with eighteen passengers, at the rate of eight miles an hour! The following communication from Dr. Mitchill, of New York, though it does not furnish much additional information on the subject, seems decisive as to the matter of fact.

What is meant by there being *no boiler*, we cannot, however, comprehend. The inventor is a blind man, of the name of Hawkins.

"New York, June 4, 1824.

"I had heretofore supposed the ingenious and celebrated James Watt had brought this machine nearly to a perfect state, and I was confirmed in this belief by a declaration my friend, the late Robert Fulton, once made me, that Watt's engine was good enough for him, and he would not presume to attempt an improvement on the work of so great a master.

"Yet, on witnessing the engine of Mr. Hawkins in actual operation, and learning, from indubitable testimony, that, small as it is, it has been employed to propel a boat through the water with eighteen passengers, it struck me as a tried project, or verified experiment, which only required enlargement and extension, to evince the simplicity, economy, and efficacy it seems to possess.

"As I belong to a sect called *the mat-*

ter-of-fact man, I rejoice to find the design of the inventor so far realized.

"It can scarcely be expected that persons who have constructed and procured steam-boats upon the existing plan, will immediately change their apparatus; but it may be reasonably supposed that individuals who are engaging and preparing steam-vessels, will adopt the construction of Hawkins.

"I forbear to dilate on a subject fully explained in your *bill of instructions*,* though I must remark, that the celerity, steadiness, and compactness of his mechanism, exceed, in practical effect, every thing of the kind I had ever expected to behold.

"It delights me to witness the exertions of genius in any case; more so, when they are made (pardon the patriotic feeling, for I ought to be a citizen of the world) in my own country; and still more so, by luminaries in the circle of my actual acquaintance.

"You understand by this time, that I think so favourably of the invention, that I wish it to be speedily and properly introduced, preparatory to its general reception. For, if he does not succeed, I really do not perceive the reason why.

"Though the inventor, like Homer, Milton, Sanderson, Moses,† and Blacklock, yet is deprived, by a severe calamity, of outward vision, I hail him on the enjoyment of an ample and distinguished portion of intellectual light.

"Truly yours,

"Samuel L. Mitchill."

ANSWERS TO INQUIRIES.

No. 32.—BRONZING.

A friend has furnished me with the following method of bronzing plaster figures (which I take to be the sort meant by "A Constant Reader"): First procure a quantity of isinglass, which make into size, and go over the figure with it till it ceases to absorb the liquid; then, with a small painter's brush, go over the whole of the figure, taking care to remove, while soft, any of the size that may remain on the more delicate parts; when the figure is dry, take a little very thin oil gold size, and with as much as just damps the brush, go over the whole of the object again, allowing no more to remain than causes it to shine; set it aside in a dry place, free from smoke, and in eight and forty hours it will be prepared to receive the bronze, which must be dabbed on with a little wool; when you have brushed over the whole of the figure, let it stand another day, and then, with a soft dry brush, rub off all the loose powder, particularly from the protuberant parts; it will then, if executed in a proper manner, be a good resemblance of the metal intended, and will likewise resist wet.

The following is the method of making bronze to imitate brass: Dissolve a quantity of copper filings in aquafortis; when the acid is well impregnated with the copper, pour off the solution upon some pieces of iron, by which a powder will be precipitated to the bottom; wash this powder repeatedly in clean water, and when quite dry, it is fit for use.

Omega.

No. 40.—OIL FOR WATCHES.

To the Editors of the Mechanic's Magazine.

South Lambeth, July 15, 1824.

Gentlemen;—Seeing in your last Number an inquiry as to the best oil for watches, I take the liberty of sending you a small article I lately met with in that very useful little work *The Chemist*. It is as follows:—

"*Oil for Clocks, Watches, and other fine Instruments.*

"Within a few years, a M. Chevreu has devoted a great portion of his time to the analysis of animal substances, and has made some remarkable and valuable discoveries. It results from his investigations, that all fat and oil is composed of two distinct substances: one of which, called *elain*, remains fluid at the ordinary temperature of the atmosphere: the other, called *stearine*, easily becomes solid. The former should be used for all instruments of a delicate nature, to which oil is applied, to prevent friction. It is thus obtained: oil or fat is exposed to the action of eight times its own weight of alcohol, nearly boiling; the liquid is then poured off, and on cooling, the *stearine* separates in crystals. The alcohol is then evaporated to a fifth part of the volume of the whole, and the *elain* remains, which is colourless, insipid, without smell, and difficult to congeal. Or, by

* This we have not met with.—*Edit.*

† As Dr. M. delights to be considered a *matter-of-fact* man, he will not be offended by our asking where he discovered that Moses was blind? In a certain book, with which the doctor is of course well acquainted, we read, "And Moses was an hundred and twenty years old when he died, and *his eye was* NOT DIM, or his voice abated."—*Edit*

squeezing tallow between the folds of blotting or other porous paper, the *elain* is separated, and soaks into the paper, while the *stearine* remains behind. The paper being then soaked in water, and pressed, gives out its *elain*." The *elain*, or fine part of the tallow, is what your correspondent wants; and I recommend him to try the latter method of obtaining it, and to communicate the result of his experiments to you for the instruction and benefit of others.

I am, Gentlemen,
Your obedient servant,
Not an Oilman, except in Sallad.

INQUIRIES.

No. 42.—PURIFYING GOLD.

Pride-hill, Shrewsbury.

GENTLEMEN;—I am anxious to know the process by which common jeweller's gold is separated from all alloy, and brought back to its virgin state. I have followed the instructions laid down in various Encyclopædias and other works, and have been at great expense and trouble to no purpose. I am sure the process must be well-known in London; but in country towns it is considered a *great secret*. Sometime ago I offered 30*l*. to a watch-case manufacturer in Liverpool for it, but his price was 100*l*. Judge, then, how much I shall feel obliged to any one of your enlightened correspondents who will communicate the secret. Many people, particularly chemists, fancy they knew it till they are undeceived by fruitless attempts. I hope those who are inclined to write on the subject, will first be certain that their information is correct.

I am, Gentlemen,
A Constant Reader,
NILOC ESOR.

No. 43.—A CASE IN MACHINERY.

Suppose a cylinder of any diameter, and eight or ten feet in length; a piston fitted to move with ease, but air-tight: to the bottom of such cylinder apply an air-pump, to exhaust the air in the cylinder (of course the piston will, by the pressure of the atmosphere, be driven to the bottom of the cylinder); then open a valve of sufficient capacity to admit the air freely into the bottom of the cylinder. The effect of this, I apprehend, will be to remove instantaneously the pressure of the atmosphere from the top of the piston: and there will be nothing to obstruct the return of the piston to the top of the cylinder but the friction, and its own weight, to balance which a sufficient power must be applied. But the question is, will any power be gained by the pressure of the atmosphere upon the top of the piston beyond what will be required to work the air-pump in exhausting the air from the cylinder?

The construction here described forms only a part of a projected piece of machinery; but the whole operation will depend much upon whether any power can be gained by the above means. Any information on the subject through the medium of your miscellany, will greatly oblige,

Gentlemen, your most obedient,
EPROTH.

GRAPHIC KALEIDOSCOPE.

We copy the following notice from the *Washington* (United States) *Gazette*:—

"An invention of great importance in the arts, and particularly in bank-note engraving, has lately been perfected by Mr. William J. Stone, of Washington, by which an endless variety of figures can be produced, in a manner that we believe to be inimitable. We cannot give the reader a better idea of the peculiar powers of this machine, than to compare it to a kaleidoscope, in forming combinations of the most beautiful figures that can be imagined. They are formed of one continued line, crossing and entangling themselves in the richest variety.

"This apparatus is composed of two cylinders, on the surface of which, levers are attached, with moveable fulcrums; and, as the cylinders pass and repass each other, they shift the fulcrums in the evolutions, which give motion to another lever of singular construction, and to which a chisel is attached for cutting the figure. Nothing that we are acquainted with, in the whole circle of the arts, presents such a formidable obstacle to forgery; and we are assured, by the inventor himself, that no two machines of this description can ever produce the same work.

"Here, then, it is probable, is the desideratum so long sought for by the Bank of England, and for which so tempting a premium has been offered. The inventor, we are told, is so confident of the utility of his discovery, that he intends to repair to London, for the purpose of submitting it for inspection in that metropolis."

NEW PATENTS.

To James Viney, of Shanklin, Isle of Wight, colonel in the Royal Artillery, for his method of supplying water or fluids for domestic or other purposes in a manner more extensively and economically than has hitherto been usually practised.—22nd May—6 months.

To Joseph Wells, of Manchester, Lancashire, silk and cotton manufacturer, for his machine for dressing, stiffening, and drying of cotton and linen warps, or any other warps that may require it, at the same time the loom is working, either with the motion of the loom or other machinery.—26th May—6 months.

TO OUR READERS AND CORRESPONDENTS.

We regret that our absence from the press last week has been the cause of one or two material errors. The article copied from the *Chemist*, and entitled "Infallible Barometer," had previously appeared in the Mechanic's Magazine, Vol. I, p. 204; and its fallacy had also been subsequently pointed out at p. 238. In the description of the "Lock Security," the following postscript was overlooked by the printer:—

"N. B.—I had almost omitted to point out, that with my additional security to doors, where there is a key-hole and no lock on, and where the door opens *internally*, it can be equally secured by having a plate similar to C, made with a projecting flat piece from its side, to bear against the door-post externally, as in A A, which is a front view of the circular plate C, for sliding over the shoulder of piece B, with the addition of A A to it."

"A Welchman" is informed, that an Index to Vol. I. has already appeared in a Supplement, published along with No. 29.

"Observator et Legor's" notions of "nonsense" are on a par with his politeness. He is angry because we take an interest in the promotion of Mechanics' Institutions!

We shall keep in view the object of Mr. Andrews' private note. His sets of formulæ for steam-engines, &c. will be acceptable.

B. N.'s model, with the accompanying description, has been received. We have shown it to several intelligent individuals, who concur with us in thinking, that the improvement he has introduced is calculated to be of great practical utility. We shall give a description of it as soon as the requisite engravings are prepared.

John's former communication was not kept back because he signed *Jack*, but because the subject seemed to us exhausted. His last shall have a place.

We beg to refer Messrs. H. on the subject of "consuming smoke," to the articles on that subject in our 8th and 44th Nos. If they desire any further information, they will let us know.

We shall be glad to receive the further observations proffered by E. W. S.

"Engineer"—We shall inquire.

Omega, on "drawing the segment of a circle," is intended for insertion.

X. Y. Z.—Mr. Cole's address is No. 1, Thames-street, London-bridge.

The description of an improved Syphon, with which we were favoured some time ago by a correspondent, has unfortunately been mislaid. Can he oblige us with another copy of it? The engraving is ready.

Communications received from J. R. R.—Anger—Q. T.—Mr. Pasley—A bit of a Mechanic—T. H.—R. M.—J. H.—Mr. Gray—Aërial—James Collins—George Thurnell—W. Thorold—R. W.—A Mechanic in Chester—Dixon Vallence—A Constant Reader—G. A. S.—T. P——le—F. J.—G.—G. W.—Cousons—J. Deacon—J. W. W.—Y. L. D—D. L. R. R. G.—J. Imlay—A. B. Q.—Fe—John Lignum—A Glazier—Lever—D. S.—Inquirer—Philotechnicos—J. M., jun.

ERRATA.

Vol. II, p. 264, line 18, for *by* the angle A B D, read *try* the angle A B D; *l.* 31, for *triangle* at A, read *angle* at A; *l.* 37, for B H, read b H; *l.* 46, for *ultimate* angles, read *alternate*.

Ibid. 2nd col. *l.* 4, for *as* a semicircle, read *or* a semicircle; *l.* 5, (from bottom) after the words produce B C, read thus:—"Unless we produce B C and A B to meet in F; hence it is evident, that to make the leg A D of the rule tend to the point C of the line B C, it must be shut from D to C."—P. 265, 2nd col. *l.* [illegible], for A E C D F R, read A E C D F B.—P. 270, 1st col. *l.* 11, (from bottom) for *boiler*, read *circle*.

Communications (post paid) to be addressed to the Editors, at

THE PUBLISHERS,

KNIGHT AND LACEY,

55, *Paternoster-Row, London.*

T. C. Hansard, Paternoster-row Press.

Mechanics' Magazine,
Museum, Register, Journal, & Gazette

Rough Industry; Activity untir'd,
With copious life inform'd, and all awake:
While in the radiant front, superior shines
That first paternal virtue—Public Zeal;
Which throws o'er all an equal wide survey
And, ever musing on the common weal,
Still labours glorious with some great design.—*Thomson.*

No. 48.] SATURDAY, JULY 24, 1824. Price 3d.

STATUE OF MR. WATT.

The above is a drawing of the statue of Mr. Watt, by Chantrey, exhibited this season at Somerset House. It was executed, we understand, for Mr. Watt's son, and is intended to be placed over his father's remains in

Wandsworth church, near Birmingham. It is truly described, in the following letter from Mr. Turner (to whom chiefly, we believe, the honour belongs of calling the recent public meeting in the metropolis) "the finest work of modern art." Seldom have we seen in marble a more exquisite or expressive delineation of human form and character. The artist, as has been well remarked, has "not only set before us the express image of a man of whom we all mourn the loss, but makes that man think and invent anew."

MR. WATT'S MONUMENT.

Rook's Nest, Godstone,
July 15, 1824.

GENTLEMEN;—In your Journal of the 26th ult. I observe you introduce your account of the meeting held at the Freemasons' Tavern, on the 18th of that month, for a Monument to the late Mr. Watt, by a quotation from a recent work of M. Dupin, which you seem to imply was the immediate cause of his majesty's ministers calling that meeting.

Now, Gentlemen, without detracting in the smallest degree from the candour of M. Dupin, who has, with the utmost liberality, borne uniform testimony to the merits of Mr. Watt, I cannot but feel it due to those personal friends of the latter gentlemen, at whose instance the measure was brought forward, to state, that at the time it was first agitated, and even at the moment when the public meeting took place, M. Dupin's work alluded to was altogether unknown to most, if not to all of them. The matter as stated in your Journal, implies a national reflection, as if the country at large had not sufficient discernment to appreciate their obligations to Mr. Watt's talents, and were equally wanting in gratitude by neglecting to commemorate them. This impression I am sure you will be anxious to efface; and another also, which is equally incorrect. The public meeting was not called by his majesty's ministers; they were applied to by the gentlemen with whom the measure originated, in the hope that a parliamentary grant might have been recommended; this, for many reasons, was not deemed advisable; but the Earl of Liverpool, and others of his majesty's ministers, pledged themselves to support the measure adopted, and redeemed that pledge by their attendance at the public meeting, and the individual testimony which they expressed of Mr. Watt's merits as a benefactor to his country, and to which, above all, they added the sanction of his majesty's approbation.

One other part of the quotation I think it necessary to notice; it is where M. Dupin states "the ashes of Watt to repose in some obscure corner of some obscure cemetery." Surely, Sir, the neighbourhood where Mr. Watt and Mr. Boulton lived cannot be obscure; nor could the spot where their ashes repose remain unknown, even if it had not been illustrated by the finest work of modern art.*

Your very obedient servant,
C. H. TURNER.

LONDON MECHANICS' INSTITUTION.

We have received the letters of Mr. Conway and J. R., both members of the Mechanics' Institution, on the subject of a meeting of members which took place after the lecture on Friday evening last. The former we subjoin; the latter, which is of similar import, it is unnecessary to insert.

For the information of many members who were not present, and in explanation of our own share in the proceedings, we must previously detail them as briefly as we can.

In the beginning of last week, we learnt, *by the merest accident*, from a member of the Institution, that there was to be a Special General Meeting held on the Friday night after the lecture, to hear a Report from the Committee of Management concerning a Building for the purposes of the Institution. We inquired "whether the meeting had been advertized in any way?"—'No, it had not!' "Had it been notified by a circular letter to the members?"—'No!' "How then had it been announced?"—'By a notice *to such members as were present* on the two preceding lecture-nights!' Not having been present at either of these lectures (owing to absence in the country), our ignorance of the notice was at once accounted for; still we could not help being in great doubt whether that could be a legal General Meeting, of which there had

* The statue by Chantrey.

been no public advertisement, nor any circular notification to the members, and of which so many might remain utterly ignorant, merely because (like ourselves) they happened to be absent from two lectures, at the end of which the meeting was announced. We were slow to believe that the laws could have been so framed, that a General Meeting, on the vote of which, measures of the last importance to the Institution might depend, could be legally got up on so very partial a notification. We referred accordingly to the laws themselves, and so far were we from finding there any authority for this clandestine method of convening a Special General Meeting, that we could not trace by what right or power such a meeting was called at all. The Laws state expressly, that there shall be but Four General Meetings in the course of the year; and though there are many and large powers given to the Committee of Management, we could not find one which authorized them to add to the number of General Meetings.

With this impression on our minds, we went to the anomalous sort of meeting on Friday night last. At the close of the Lecture, the worthy President told the members present, that they would *now constitute themselves into a Special General Meeting of the Institution*, for the purpose of considering the fitness of certain premises which the Committee had found out, and which they thought well adapted for the purposes of the Institution; and forthwith Dr. BIRKBECK proceeded to describe, in a very clear and distinct manner, the various advantages of the premises alluded to — their central situation (Southampton Buildings, Chancery Lane)—their capaciousness—the long lease which can be obtained of them, &c.

When the President had concluded, a Member, with whose name we are not acquainted, rose, and in a very neat and modest speech, which was received with much applause, proposed a resolution, *authorizing* the Committee to conclude a bargain for the premises in question.

The Resolution having been seconded,

Mr. ROBERTSON said, that before proceeding farther, he would be glad to know from the President, or from any other Member of the Committee, how far the present was such a meeting as the Rules and Orders recognized? and whether, particularly, it was so constituted as to be competent to *authorize* any thing whatever *in the name of the Institution?*

Dr. GILCHRIST, one of the Vice-Presidents, answered:—He did *not offer to show that the meeting was called in virtue of any rule or order;* it had been called by the Committee, merely out of courtesy. The Committee had *no* occasion to call any general meeting, for they had power of themselves to conclude the proposed bargain; they thought it as well, however, to have the approbation of the members at large; and was it to be endured, that they should now be quarrelled with for their condescension? [*The Doctor was angry*].

Mr. MUDIE thought this was not a satisfactory answer to the question put. Nobody disputed the propriety of consulting the Members at large on the subject. The Committee had acted most laudably in doing so. Still, however, the question recurred—Had the Members been convened in a manner sanctioned by the laws? Was the present meeting a legal one or not? Could it do any thing that would be binding as an act of the Society?

The PRESIDENT observed, that there was no doubt the Committee possessed, of themselves, sufficient power to conclude the bargain; and that all they wanted, was to know whether the members at large approved of the *situation of the* premises in question.

Mr. ROBERTSON said, that the question as to the legal power of the Meeting to *do any thing*, was still left unanswered. He saw the learned Solicitor of the Institution present, and would be glad to have his opinion on the subject?

Mr. TOOKE thought, that by the 46th law, which directs the Committee to "apply so much of the income, and revenue of the Institution, as may be necessary in payment of *rent* and *taxes*," &c. they had the full power of themselves to conclude a bargain for the premises in question; but that they had, at the same time, acted with great propriety, in applying for the sanction of their constituents on the occasion; the learned gentleman, however, said "nothing as to the legality of the manner in which these constituents had been assembled to give this sanction."

Mr. STACY (a committee-man) thought that the meeting was a legal one under that law (33) which says, "The committee of managers shall have the care and superintendence and control of the Institution;" but *how*, he did not explain.

Mr. WHITTAKER (another committee-man) thought it one of the strangest things imaginable, that the committee should be blamed for being too liberal. The laws required, that there should be only four general meetings of the Institution; the committee had given *one more as a boon*, and yet this boon was objected to!!!

The President then proposed to put the Resolution to the vote, admitting, at the same time (notwithstanding the able arguments of Messrs. Stacy and Whittaker) that the resolution could not be considered as that of a regular general meeting of the Institution, but only as the opinion of a numerous meeting of members assembled after the lecture.

No farther objection was made, and the Resolution, *in that modified shape*, was carried *nem. con.*

We now give the letter of Mr. Conway, who, it may be proper to remark, is personally unknown to us.

Sir;—Being present on Friday evening last at the Mechanics' Meeting (as a member of the Institution) I became an attentive and interested auditor to the proceedings following the lecture, and I cannot but express my surprise and regret at the angry and the unargumentative answers which followed your question, "as to whether the Committee really possessed the power of convening a special general meeting?" You thought they did not, and that of consequence neither could the business of the evening be minuted, nor the Committee act upon the votes and decisions of the meeting, as those of the general body of members legally convened. Dr. Gilchrist was the first who rose to answer (whose glow of temper on the occasion can only be excused from his warmth of heart), and as one of the committee, he stated, that the members were not called together on this occasion to give warranty to the acts of the Committee, for that they (the Committee) were invested with full discretionary powers to proceed in the purchase of property, &c. to whatever extent their collective wisdom might deem fit; that the question as to the propriety of engaging certain premises was merely submitted to the members out of courtesy, and that the meeting was not to be considered as a general one specially convened, &c. Now the greater part of this may be true; at least, I am not competent to argue that it is not. But with respect to the last assertion, I beg to remind the good Dr., that more than once in his hearing, our very worthy President announced his intention of calling a Special General Meeting, and that when we were accordingly assembled last Friday evening, the first thing he did was to constitute and denominate us a Special General Meeting. Nor have I any hesitation in saying, that had your question not been urged, our proceedings would have been recorded as that of the general body legally convened, which it is now confessed they were not.

Though I must own your demurrer fell like cold water on the ardent and well-intentioned spirits of the Committee, yet I cannot but respect the dictates from which it appeared to spring; feeling persuaded that you were actuated by a laudable jealousy of the slightest infringement on our laws, which might perhaps hereafter be pleaded as a precedent, even to the destruction of this noble and philantropic Institution.

My intention in writing to you, Sir, is, as a member of the Institution, to tender you my thanks for this proof of your integrity, and to pray your future watchfulness (for as men, I deem our Committee liable to err, though I am certain, should they do so, it will be from the best of motives), lest, by any little stretch of power to attain a present superficial advantage, we may be opening a door to the most dangerous innovations at some future period. I was sorry, amidst the profusion of courtesy, so little fell to your share, and doubly sorry to see dissension growing where we most need unanimity. I would pray the gentlemen of the Committee to hear and answer every man dispassionately. If he is in the wrong, disprove his assertion by argument, and not silence him by equivoque, nor intimidate him by asperity, lest they create a strong, though silent dislike, where only would have sprung up a pleasant spirit of opposition, necessary to give zest and animation to all general discussions.

I am, Sir, your obedient, &c.

G. M. CONWAY.

27, Camomile-street,
Bishopsgate.

[A good deal remains to be said on the conduct of the Committee, in relation to procuring a building for the Institution, which it was not worth while to state on Friday evening, seeing the course matters took. We have only room at present, however, for a very few words more. Our excellent President, in detailing the particulars of the bargain, which the Committee propose to enter into for the premises in Southampton Buildings, spoke of a lease for *some hundred and forty years*, at a rent, with taxes, amounting to nearly *three hundred pounds*. But is such a lease to be procured without some persons binding themselves and their heirs to pay the said rent during the whole of the said period? Who, then, are the persons who will so bind themselves and their heirs, for the sake of the Institution, and in dependance on it as it is at present constituted? Not our trustees certainly, who have but a few pounds, if any, in their possession. Not the fifteen members of the present Committee, who are just on the eve of retiring from office, and who are so active in forwarding the bargain for a lease, which they must leave others *to sign*. Nor, we firmly believe, any Committee of managers that ever existed, or ever will exist, as long as they are in possession of their senses, and have a proper regard for themselves and their families. The Mechanics' is not, as yet, an Institution so constituted, that any obligation come under by its Committee of Managers, can be perpetually binding on the general body of the members; and while this is the case, before any contract for a lease can be entered into, either by the Trustees or Committee, for a longer term than one or two years, there must be an appropriated fund capable of meeting every demand for rent, taxes, and repairs, during the stated period of the lease. At present, there is no such fund; nor (as far as we know) is there any plan in progress for providing it. The Members may stop their annual subscriptions when they please; their numbers may possibly diminish to one hundred or fifty; and what then is to become of the Managers and their lease—their heirs and the hundred and forty years obligations entailed upon them? The fact is, the Committee, to use a common phrase, are putting the "cart before the horse." All their care (as is too commonly the case with the directors of new institutions) is to have a grand house and establishment, while the means by which we shall ever be able to maintain these, are either wholly neglected, or but negligently cultivated. A house fit for every present purpose of the Institution, with rooms for a library, a museum, elementary schools—every thing, in short, but the lectures (a theatre for which will still have to be built, should even the premises in Southampton Buildings be taken)—might *long ago* have been procured for little more than the Committee are now paying for a couple of apartments in Furnival's Inn (£.55, we believe, per annum); and had such a house been taken, the Members might, by this time, have been reaping the benefits of a large library of circulation, from which (with all deference be it spoken) they would derive more instruction than from all the courses of lectures that can be delivered; elementary schools, too, might have been formed, as at first held out, where, in classes of fifty or sixty, the Members might be taught those rudimental matters which do not come at all within the province of public teaching; the "museum of machines, models, minerals, and natural history," would also have had a commencement, and might, ere now, have attained to importance; the result of all which would have been, that the benefits derivable from the Institution, would have been more than tripled, the number of members probably more than doubled, and a foundation laid for future and lasting prosperity, which we are grieved to say is yet wanting.

For what are all these important objects of the Institution sacrificed? For handsome apartments in Furnival's Inn for the accommodation of the Committee and Secretary, and the hope of still more stylish ones in Southampton Buildings. Furnival's Inn is a most gentlemanly place certainly; and our Secretary's hours are also very gentlemanly (from ten to four); but neither is it a place where humble Mechanics like to resort, nor are the hours such as a Secretary consulting the convenience of men working from sun-rise to sun-set would ever have thought of appointing. The Mechanics want no such style; they want to see more of the solid benefits which the plan of the Institution held out to them, realized as speedily as possible, and in the cheapest way possible; and unless the Committee continue obstinately blind to the real interests of their constituents, they will at once employ the money which they have in hand for these purposes, and abandon all thoughts of castle-building for the present. — A building, such as will do honour to the Institution, may, and we trust will, ere long, grow out of the prosperity of the Institution; but it is in vain to look for it by any quicker process.—*Edit.*]

JORDAN'S PANMETRON OR UNIVERSAL MEASURE.

(Concluded from our last).

IX.—*To construct an equilateral triangle on the given line*, C B. Fig. 5. [See Engravings in last No.]

Apply the Metron with its small angle turned to each extremity of the line.

X.—*On a given line, as* A B, *to construct an isosceles triangle, having each of the angles at the base double the vertical angle.* Fig. 9.

Bisect the given line A B, perpendicularly (by Prop. III.) by the line C D; apply 10 of the polygon line (as marked on the base A of the Metron) to the point A of the given line, and let 0 of the same polygon line touch the line C D, as at F; produce the line F A to 6 of the polygon line, as at G; draw G H parallel (by Prop. I.) to A B, until it meets F B produced at H, and G H is one of the sides of the isosceles triangle required; which, if applied from A to C, and a line drawn from C to B, will give the isosceles triangle A C B, having each of the angles B A C, A B C, double of the angle A C B.

XI.—*To inscribe in a given circle any of the regular polygons from 4 to 12 sides.* Fig. 10.

Let A B be the diameter of the given circle, in which it is required to inscribe a hexagon. Take any line C D equal to the diameter A B, look on the polygon line of the base A of the Metron for figure 6, (the number of sides which the polygon is to have), and opposite it in the inner line is 60, the number of degrees which measures the arc subtended by the side of a hexagon inscribed in any circle; take the half of 60 deg., which will be the angle at the circumference; make the angle D C E (by Prop. VIII.) equal to 30 deg. and from D let fall D E (by Prop. II.) perpendicularly on C E, and D E is the side of the hexagon required.

Or, you may find the side of any of the regular polygons from a four to a twelve-sided figure, by having the radius of the circle given thus (fig. 11):—

Let *d e* be a line representing the radius of a circle; it is required to find a side of each of the regular polygons from a four to a twelve-sided figure, which may be inscribed in the circle whose radius is equal to *d e:* draw a line through *e* in any manner, as *e* C, and apply 6 of the polygon line on the base A of the Metron to the point *d*, and let 0 of the same polygon line touch the line C *e*, as at C; and by the base A of the Metron draw the line C *d b*, and make marks opposite the divisions of said polygon line, as at 4, 5, 7, 8, 9, 10, 11, 12; then through these points, and parallel to *d e* (by Prop. I.) draw the lines 4,4, 5,5,—7,7, &c. &c.; then will the line 4,4, be the side of a square 5,5, the side of a pentagon 6,6, the side of a hexagon, &c. &c. which may all be inscribed in the circle whose radius is the given line *d e*.

It is easy to see from this figure how you may find the radius of the inscribed circle of any regular polygon by having given one side.

XII.—*Having given the diameter of a circle as A B, to find the side of the circumscribing polygons from a four to a twelve-sided figure.* Fig. 10.

Required to find the side of a hexagon which may be circumscribed about a circle whose diameter is A B: having in all respects made the triangle D C E the same as directed in the foregoing Prop. with the exception of making C g equal to A B, the given diameter, and from g making $g\,f$ perpendicular (by Prop. II.) to C E; then will $g\,f$ be the side of the circumscribing hexagon as required.

XIII.—*To reduce an irregular polygon a, b, c, d, e, f, g, to a triangle of equal area.* Fig. 6.

Through the point *a* draw the line *i h*, in any manner or angle you please; then imagine a line drawn from the point *a* to *c*, and parallel to it (by Prop. I), from the point *b*, draw a line to cut *i h*, as at 1; then suppose a line drawn from 1 to *d*, and parallel to it (as above) from the point *c*, draw a line to cut *i h*, as at 2; in the same manner, a line supposed to be drawn from 2 to *e*, and parallel to it, from the point *d*, draw a line to cut *i h*, as at 3; then from this 3 to *f* suppose a line to be drawn, and parallel to it from the point *e* draw a line to cut *i h* in the point 4; then from 4 to *g* suppose a line to be drawn, and parallel to it from the point *f* draw a line to cut *i h* in the point 5; then from 5 to *g* draw the line 5 *g*, and the triangle *a g* 5 will be equal in area to the given irregular figure, *a, b, c, d, e, f, g*.

XIV.—*The right sines of three arcs being given, to find a fourth in proportion.* Fig. 7.

Let the three right sines 16 deg. 30 min. 36 deg. 8 min. and 9 deg. be given to find a fourth proportional: draw two right lines A B, A C at any angle; set from the line of sines on the leg C of the Metron A D equal to 16 deg. 30 min., A E equal to 36 deg. 8 min., and A F equal to 9 deg.; join D E, and through F draw F G parallel (by Prop. I.) to D E, then A G will be the fourth proportional required; to which, if the line of sines on the leg C of the Metron be applied, the point G will be against the number 19 deg. 00 min. the sine required.

So by the line of tangents on the base A of the Metron may be found a fourth proportional tangent.

XV.—*To find the right sine of any arc in proportion to a given radius.* Fig. 7.

Let the line C K be the radius of a given circle; it is required to find a line representing the right sine of 36 deg. 8 min.: from C draw C A in any angle at pleasure, and make C A equal radius or sine of 90 deg. and A E equal 36 deg. 8 min. from the leg C of the Metron, and join A K, and through E, parallel to C K (by Prop. I.) draw E D; so is E D a line resembling the sine of 36 deg. 8 min. agreeable to the given radius C K, as required.

If this sine were required in numbers, that is, in parts of the radius, supposing the radius to be put to 1000, it is only to measure the line A E with the line of equal parts on the leg D of the Metron, and it will be found to contain 590, which is the right sine of an arc of 36 deg. 8 min. if the radius is put to 1000.

And in the same manner may a proportional tangent or chord be found, either in a line or in numbers, in proportion to any given radius.

By looking at fig. 7, it may be easily understood, that if a line given resembles a sine of an arc, from it you may find the radius in proportion thereunto.

XVI.—*To find the height of a tower A B, whose base is accessible.* Fig. 12.

Let the angle of observation be supposed to be 33 deg. 30 min., and the distance of the place of observation from the base of the tower 66 feet; required the height A B: make C A equal 66 of the line of equal parts on the leg D of the Metron, and from the point C make the angle A C B (by Prop. VIII.) equal 33 deg. 30 min. and from the point A draw A B perpendicular (by Prop. II.) to C A, till it meets C B; the length A B measured on the same line of equal parts on the leg D of the Metron, will be the height, 44 feet nearly;—or thus, to find the height of the tower A B (fig. 12) by instrumental calculation, the observed angle A C B and the distance of the place of observation being given, as in the preceding proposition: draw the lines A B A C (fig. 7) forming any angle at pleasure; take A *e* on the line of sines from the leg C of the Metron equal to 56 deg. 30 min., the co-sine of 33 deg. 30 min; take A *f* equal 66 of the line of equal parts on the leg D of the Metron, and then make A *g* equal 33 deg. 30 min. (the observed angle) from the same line of sines as A *e* was taken; join *e f*, and through *g* draw *g h* parallel (by Prop. I.) to *e f*; A *h* measured on the line of equal parts, will give 44 feet nearly, the tower as before.

And in like manner may you also find an inaccessible height or distance; and in case a quadrant could not be obtained, a little contrivance may make the Metron measure the quantities of angles both horizontal and vertical.

LINEAR STANDARD—ONE EQUAL TO TWO.

Lincoln, July 10, 1824.

GENTLEMEN;—Perhaps your correspondent, "H. C. Jennings," will have no objection to favour your readers with a plainer description of his method of obtaining a linear standard (p. 230). I am afraid many of them, like myself, will not be able to understand his meaning about the sun's image a foot in diameter, and "its subdivision into ten parts, the decimal of a foot," &c. I suppose it must be done by means of a telescope, in a dark room; and certainly nothing can be more difficult to measure than such an image, both on account of its direct motion (which will be over a space of 6 inches in a minute), and also the tremulous motion occasioned by the floating vapours of the atmosphere, the shaking of the telescope, and other causes: nor do I understand the extent of the limitation of time when the observation is to be made, which he says must be at 12 o'clock, "on any one of three or even seven days in the month of August, or any other month," by which it would seem to be limited to any day in the year.

A MECHANIC.

P. S.—I see nothing in the communication of "R. B." (p. 236) at all applicable to the subject he alludes to. The argument on which I showed the assertion to be founded, has been repeatedly brought forward by superficial persons, not with a view to prove what every one knows to be false and absurd, but to degrade the mathematical sciences, by showing, as they suppose, that they sometimes lead to false conclusions. The object of my remarks was, to endeavour to show that in the present case the charge is without foundation, and surely such an attempt may be made without subjecting the person who makes it to the imputation of Quixotism. "R. B." says, "If *a*, *b*, *c*, *d*, are to be considered as part of a series in geometrical progression," &c. I say they are not to be so considered, for the best of all possible reasons, namely, because they are *not* in such progression in the present case. Where did your correspondent learn that every proportion is necessarily part of a geometrical series?

QUODLIBET'S PROBLEM.

GENTLEMEN;—It is a curious circumstance that so many solutions to Quodlibet's problem should be all similar; but I perfectly agree with your correspondent J. Y. in his remarks, and also think it was owing to the wording of the problem that the coincidence took place. For my own part, I understood that a *square* was to be taken from the original square equal to its fourth-part, and that the other three parts were to be divided into four other portions exactly alike in *all* their dimensions: but from the way it is now proposed, I agree that a variety of solutions may be given, of which I now send four for your consideration. The three first need only be drawn to show the truth; for as the whole square is made up of sixteen smaller squares, we may, according to the words of the question, take any four of them (provided one of them is situated at the angular point), and then arrange the other twelve, as the figures clearly show: the shaded part shows the fourth of the original square.

The fourth method, which appears

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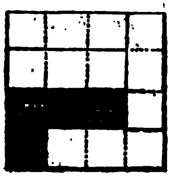

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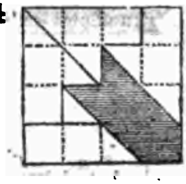

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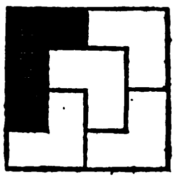

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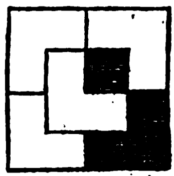


rather more complicated, but which I think, without entering into any strict geometrical demonstration, will appear plain from the fourth figure, where the shaded part is equal to a quarter of the whole square, by being made up of two squares and four equal triangles, or half squares; and the strong lines show four equal and similar figures made up of two squares and two triangles similarly situated.

I am convinced many other solutions might have been given, but I think these are quite sufficient to stimulate others to similar exercsies, conceiving them to be well calculated for a work which, like yours, is meant to instruct as well as amuse.

I am, Gentlemen, yours, &c.

G. A. S.

[Quodlibet, since the appearance of the answers to his problem, has written to us, stating that "there was a mistake respecting the *number* of divisions required; and that what he meant to propose was, that 3-4ths of the square should be divided into *five* equal parts, instead of *four*, of the same *shape* or *form*, or of the same *size* or *extent*, which he conceives amounts exactly to the same thing as shape or *area*." This he *thinks* is impracticable.—EDIT.]

IMPROVEMENTS ON AXLES AND SPRINGS OF CARRIAGES.

To the Editors of the Mechanic's Magazine.

May 14, 1824.

GENTLEMEN;—Since I sent you a description of my spring-barrow, I have seen several such in and about London; so, perhaps, I am not the *first* inventor of it: no matter. I now send you a description of two improvements (as I consider them), which have occurred to me—one on axles, and the other on springs of carriages.

The arm of the common axle is generally made conical, merely because more strength is requisite near the point of pressure than at a dis-

Fig. 1.

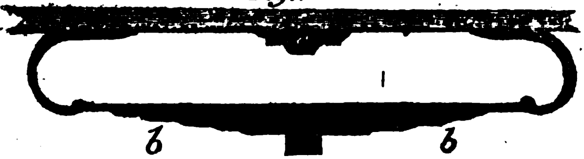


Fig. 2.

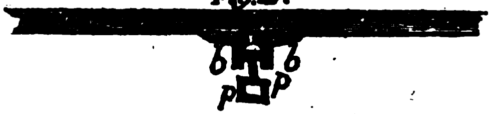


Fig. 1.

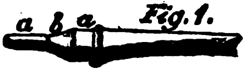


Fig. 2.

tance from it. It might, certainly, be made cylindrical, like Collinge's patent axle; but this form, for waggons, would, by increasing the rubbing surface, increase the friction considerably. On this account it is, I believe, that the arms are taper or conical. But in this case, they must be so bent or inclined that the lower part may be horizontal; for otherwise the wheel would constantly press against the linch-pin; and when thus inclined, if the lower or supporting spoke be perpendicular to the surface of the conical arm, it results that the wheel must be *dished* and conical. Now, it appears to me, that the friction of a broad conical wheel *on the road*, must exceed that occasioned by a cylindrical wheel *on the axle*, even supposing that axle to be enlarged into a uniform cylinder.

From the foregoing considerations, I am led to propose that the arms of axles be formed into cylinders, diminishing in diameter or calibre towards the extremities, for which boxes to correspond could easily be cast. This modification would, I think, embrace the advantages and avoid the disadvantages of the old-fashioned conical arms.

I have observed, that when springs are attached to vans, waggons, or carts, for the conveyance of heavy loads, there is generally a piece of wood nailed or bolted under the shaft or body of the carriage immediately over the centre of the spring, to prevent it from bending, in case of great jolts, so much as to break. Now, the fault of the grasshopper-spring is, that its power of resistance does not increase in an equal proportion with the increase of pressure.

In fig. 1, *a a*, is the shaft; *c*, the stop, against which the middle of the spring *b b* occasionally strikes, and then ceases to be useful as a spring.

I propose to substitute for the block *c*, an iron or brass-piece, bored accurately, in which a well-fitted piston should play, having a strong rod, bearing upon the steel spring. At the lower end of the rod is a stirrup, which surrounds the spring, without embracing it closely. A small valve, opening inwards at the top of the cylinder, admits a supply of air into the air-chamber, should any escape.

In fig. 2, *a a*, is the shaft to which the pneumatic spring is bolted, of which *b b* represents a vertical section; *c*, the air-chamber; *v*, a small hole drilled for the admission of air (and oil, if necessary) through the valve; *p p*, the piston, rod, and stirrup.—Yours, &c. E. S.

May 15, 1824.

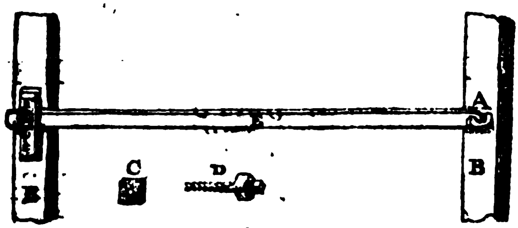
GENTLEMEN;—Since writing to you on axles and springs of carriages, it has occurred to me, with regard to the former, that perhaps another form may sometimes be adopted with advantage. This is represented in the annexed figure 1, that formerly recommended by fig. 2.

But when fig. 1 is adopted, the box should be cast so that the axle should only bear upon the cylindrical parts, *a a*, and not on the conical part *b*.

I am yours, &c.

E. S.

BAR AGAINST HORSE STEALERS.



Gentlemen;—I take the liberty of sending you a plan of a bar against horse-stealers. W. A. D.

3, College Terrace, Sandhurst, Berks.

Description.

A, the staple, strongly riveted into the post; BB, the door-posts; C, the nut let into the side of the post; D, the screw, with a triangular end to fit the key; E, the bar, 2½ inches wide, and ½-inch thick; F, a piece of oak screwed on for the support of the bar, which is fixed exactly half way up the posts.

ELECTRICITY OF PAPER.

Colchester.

Gentlemen;—Your correspondent, H. B., in page 172 of your second volume, has rightly *conjectured* the adhesion of paper when rubbed to be caused by the presence of the electric fluid, but does not appear to have gone far enough in his experiments to *prove* it.

I accidentally discovered the same thing myself during the present winter; and having an electrical apparatus, and suspecting the cause, I immediately applied an electrometer, with two insulated pith-balls. These, when brought within the atmosphere of the paper, were immediately and powerfully attracted, and again repelled. I then removed the electrometer, and found the balls so powerfully electrified, that they diverged to the distance of an inch, and so continued for some time.

Having warmed and excited the paper a second time, I put out the candle, and presented my knuckle, and obtained from the paper strong and numerous sparks, accompanied by the electric light from different parts of its surface.

It is well known that the power of a common electrical machine is greatly increased by setting it at a moderate distance from a fire for a few minutes previously to working it; and it is therefore not surprising that the same effect should be produced on paper, which is, as well as glass, an electric, though not so perfect, and which, for that reason, will require more heat to produce the same effects.

Neb Dirpe is right in saying that the effect on glass "is equal to that on wood;" but this only proves more strongly that its cause *is* the electric fluid; in proof of this, let him turn the cylinder of an electrical machine for about a minute, and then endeavour to raise the silk flap which is attached to the rubber, and he will find that its adhesion to the cylinder is so strong (if the machine be in good action) that it will require some little force to separate them: the causes for this adhesion being greater than that of paper are two—first, that the friction of the rubber against the cylinder being more complete than that of the India rubber on paper, more of the electric fluid is produced; and second, that the silk being a more perfect non-conductor than paper, the fluid thus generated is better retained between its surface, and that of the glass, which surfaces being in opposite states of electricity, are, according to the theory of Dr. Franklin, attracted by each other.

Hoping that I have satisfactorily proved that the phenomenon referred to is to be ascribed *only* to electricity,

I remain, Gentlemen,
Yours respectfully,
J. M.

IMPROVED CLOCKS.

Grenada-terrace, Commercial-road,
July 9, 1824.

GENTLEMEN;—I have not the least doubt but most of your correspondents are acquainted with the nature and construction of the three-wheel clock invented by Dr. Franklin, also of the improved one invented by James Fergusson, F. R. S. Now, by the hours on Dr. Franklin's clock-face being marked in a spiral line at but four places, a person, by waking in the night, might be deceived in four hours. Mr. Fergusson's is undoubtedly an improvement, as by his, every hour, minute, and second, can be told at any time; but as Mr. Ferugsson's clock has but one moveable hand, and two fixed hands, it may be considered as but an ingenious contrivance and good make-shift, as the time cannot so readily be told by it as by the clocks commonly in use; neither is there any other method of setting either of the above clocks than by turning each hand by main force on its respective centre, which would soon occasion them all to become loose.

As I considered that neither Dr. Franklin's or Mr. Fergusson's could be called a complete three-motion clock, I in 1817 constructed one of three wheels, that tells the hours, minutes, and seconds. For this purpose it has three hands, which are fixed firmly to the axis of their respective wheels, the motions of which are all direct; and the three hands can be all set at once, by laying hold of the minute hand, and moving it either backward or forward, which will not occasion the least friction. This clock goes twenty-four hours with a six-foot chain, and to a degree of correctness that I have never witnessed in any other pendulum clock. In two months I have not been able to perceive any variation, which is probably owing to its hanging in a room of a regular temperature.

In perusing the pages of your valuable work, I perceive that it frequently occurs that there are many claimants to the same invention: now, as I do not wish your correspondents to say that I have pirated the invention, I shall give them a month to make known their own contrivances for a three-wheel clock (for I have not the least doubt there have been many constructions), and at the expiration of that time I shall give a full description of my own.

I am, Sir,
Your obedient servant,
JAMES COLLINS.

[For the benefit of those of our readers who may not be acquainted with the clocks of Dr. Franklin and Mr. Fergusson, alluded to by our correspondent, we subjoin a description of them.]

DR. Franklin contrived his clock to show the hours, minutes, and seconds, with only three wheels and two pinions in the whole movement. The dial-plate had the hours engraven on it, in spiral spaces, along two diameters of a circle, containing four times 60 minutes. The index goes round in four hours, and points out the minutes from any hour which it has passed to the next following hour. The small hand, in arch at top, goes round once in a minute, and shows the seconds. The clock is wound up by a line going over a pulley, on the axis of the great wheel, like a common thirty-hour clock. Many of these very simple machines have since been constructed, that measure time exceedingly well. This clock is subject, however, to the inconvenience of requiring frequent winding up, by raising the weight, as also, to some uncertainty as to the particular hour shown by the index.

Mr. Fergusson proposed to remedy those inconveniences by another construction, which is described in his *Select Exercises*. His clock will go a week without winding, and always shows the precise hour; but, as he acknowledges, it has two disadvantages which do not belong to Dr. Franklin's clock. When the minute hand is adjusted, the hour plate must also be set right by means of a pin; and the smallness of the teeth in the pendulum wheel will cause the pendulum ball to describe but small arcs in its vibrations; and, therefore, the momentum of the ball will be less, and the times of the vibrations will be more affected by any unequal impulse of the pendulum wheel on the pallets. Besides, the weight of the flat ring, on which the seconds are engraven, will load the pivots of the axis of the pendulum wheel with a great deal of friction, which ought, by all possible means, to be avoided.

Mr. Fergusson also contrived a clock, showing the apparent diurnal motions of the sun and moon, the age and phases of the moon, with the time of her coming to the meridian, and the times of high and low water; all this being added to the clock, by having only two wheels and a pinion added to the common movement. In this clock, the figure of the sun serves as an hour-index, by going round the dial in 24 hours; and a figure of the moon goes round in 24 hours, 50½ minutes, the period of her revolution in the heavens, from any meridian, to the same meridian again. A clock of this kind was adapted by Mr. F. to the movement of an old watch. He also gives, in the same work, a description and drawing of an astronomical clock, showing the apparent daily motions of the sun, moon, and stars, with the times of their rising, southing, and setting; the places of the sun and moon in the ecliptic, and the age and phases of the moon for every day in the year.

SHIP TIMBER.

GENTLEMEN;—I am sorry I should be the cause of throwing any one into obscurity, which I find is the case with your correspondent "Nauticus," who writes in your 35th Number respecting English oak timber in ship-building, &c.

In the first place, the word *quality* was used in my communication by mistake for *quantity*. I would have corrected this error before, but concluded that all who had any knowledge of timber, would perceive at once that it was a slip of the pen, or error of the press. To be more explicit, *I say again*, that a saving of one-third of timber may be obtained in the framing or timbering of a 74-gun ship, large merchant-men, &c. and that the ship, at the same time, will be rendered stronger. But this is not to be obtained by having timber 12 and 14 inches square; the notion that such only will do, has been the cause of a great deal of unnecessary expense to the nation. I would advise Nauticus to make an experiment (as he says he is in the habit of doing), in order to try the comparative strength of a piece of timber 12 inches square, and another piece from the same log or quality, 12 inches by 6; I am convinced that he will then be no longer an advocate for square timber: the nigher square, the less is the strength. By sawing the log down the middle, all the destructive juices of the heart, which are the cause of decay and dry-rot, will be drawn off; and the consequence will be, that instead of hearty timber, we shall obtain hardy timber, of far greater durability. From a log of 22 inches or less, there may be made two timbers in lieu of one, with sufficient bearing for the outside and inside planks; and the round part of the log, clear of sap, may also be made use of to fill up the openings between the timbers, instead of being cut up for the fire; so that the log may be wrought up without any waste whatever. I have been told that this plan would not do in men-of-war, on account of the ports; but this objection I can remove; for I find, by accommodating the ports, I can accommodate the timber pile to much greater advantage. I cannot say more on this head at present, but promise that the whole of the separate advantages which I specified at p. 444, vol. I. shall be forthcoming.

Chance lately brought me to a building of magnitude, where I found timbers prepared agreeably to this plan; they have stood the test of many, many years, and are at this moment without blemish.

I will conclude by referring Nauticus to T. H. Pasley, No. 34, where he will see the nature and quality of timber, and the principle of my plan explained in a more able manner than I am capable of doing. If he still wishes for further satisfaction, he can procure my address from the Editor, and, by appointing a time, I shall be happy to show him, by model and plan, the efficacy of the method I propose.

I remain your humble servant,

J. G.

[Mr. Morris, the writer of the letter on the same subject, at p. 284, vol. II. and who has kindly offered to give any person applying to him ocular proofs of the efficacy of his method for preventing the dry-rot, requests us to state, that his address is 35, Broad-street, St. George's in the East. It will be seen that his plan, and that of J. G.'s, proceed on the same principle.—EDIT.]

Skinner-street, July 6, 1824.

GENTLEMEN;—Having, in No. 32, contributed to your valuable Magazine on the subject of preserving ships' bottoms, I think the following method well calculated to effect that desirable object, especially if the hides could be united or joined together, as it might often prevent leakage, in the event of the vessel striking.

I am, Gentlemen,

Your obedient servant,

S. DEACON.

A SHIP IN LEATHER BREECHES!

A New York Paper says — "The schooner Eliza is now sheathing with leather, by way of proving the use of leather on ships' bottoms, as a substitute for copper, zinc, &c. A vessel lately made a voyage of thirty-seven months, which, on her departure, had a side of sole leather put on her bottom, and on her return it was found to be uninjured.

"Leather, it appears, is not subject to decay in water, or to be eaten by worms."

THE PERPETUAL MOTION.

June, 1824.

The perpetual motion is not in man, matter, or materialism: it never was created: it is, was, from eternity, the constant, *essential*, impulsive, impelling force of the Deity upon the particles of matter. If this were withdrawn, all things would be at a stand-still, man himself would be. The force is uncreated, but the particles of matter upon which its *agency* has effect, were created; it is, *in perpetuo*, the essence of Deity. It is out of the power of man to give continuity of motion to the particles of matter for an eternity; and, if they have not duration of motion, there is a time when they will become inert. It is, then, no longer the perpetual motion. The perpetual motion is the *omni-potens* of the Deity, and it is nothing short of that.

MONTIS.

P. S.—Mr. Henry Deacon's observations on the subject are most satisfactory and convincing.

ANSWERS TO INQUIRIES.

No. 37.

E. W. S. asks why 4 should be deducted. For no reason at all, or this simple one, because 15 × 3 + 3 = 48, which is 1 over to each parcel dealt; therefore these 4 cards are not wanting: but suppose we only put 1 card out of the pack, having 51 remaining: now deal 3 parcels to 16; you will find it give the same result, having 16 × 3 + 3 = 51, which is 16 to each parcel, and 1 over to each remaining. Again, suppose we take exactly the whole pack, and deal them into 4 parcels to 12; we shall find the same result, having 12 × 4 + 4 = 52, which is 12 to each parcel, and 1 to each remaining. Again, we take the whole pack, and deal into 2 parcels to 25; the same result appears, having 25 × 2 + 2 = 52, which is 25 to each parcel, and 1 to each remaining. Again, suppose we add 3 to the pack, thereby making a total of 55 cards, and deal them in 5 to 10 each (that is, in case a 10th card is first turned up, you must not deal any more to that parcel, but proceed with the next), we shall still find the same result, having 10 × 5 + 5 = 55, which is 10 to each parcel, and 1 over to each remaining; and so on invariably with any number of cards that you can equally divide by any number, only dealing to one less in each parcel than what you have got cards for; as, for instance, take 36 cards, deal 3 parcels to 11 each, because, 11 × 3 + 3 = 36; or 39 in 3 parcels to 12 each, because 12 × 3 + 3 = 39; or 42 in 3 parcels to 13 each, because 13 × 3 + 3 = 42; and as for the analogy between the numbers in the heaps and the numbers in the pack, I perceive none, but should feel obliged by your correspondent E. W. S. showing it in a future Number, if he finds any.

If these remarks are worthy of insertion, I should feel extremely happy by your giving them a space in your valuable and widely-circulated Journal.

I am your obedient servant,

JOHN LONG.

Another Answer.

In counting from the number of pips on the card you have turned down up to fifteen (the number of packs E. W. S. mentions being three), you have left as many cards out of a suit of thirteen as there are pips turned down, and used three of another. In the three packs, therefore, out of three suits you have used all the cards but a number equal to the pips turned down, and of the fourth suit you have used nine; if, therefore, you deduct the four remaining of that suit from the cards left in your hand, the remainder will equal the number of pips turned down. For instance, in turning down a six, you count 7, 8, 9, 10, 11, 12, 13, 14, 15, using six cards, *besides* the one you turned down (leaving, therefore, six out of the suit of thirteen) and the three of the fourth suit.

The usual way of doing it is, to count up to twelve only, so that each pack leaves as many cards out of a suit as there are pips turned down. Four packs, therefore, leave as many cards as there are pips turned down. For every pack less than four, you deduct thirteen from the number of cards remaining, and for every pack more than four, you add thirteen to the remainder.

D. L. E. K. G.

No. 43.—CASE IN MACHINERY.

Eproth would certainly not receive an equivalent from the piston by pumping out the air from within the cylinder beneath, inasmuch as he would find himself minus from loss by friction and other imperfections unavoidably attending the operation of machinery; but if he can persuade the piston to ascend with the same force with which it descended, or even ascend at all by means of the blast to which he alludes, egad! he will be a lucky fellow; the fact, however, is, that the air, if let in by a valve of any capacity, would produce no other effect than merely to counterbalance the weight of the atmosphere above, which had been previously supported by the plunger resting on the bottom of the cylinder. G.

INQUIRIES.

No. 44.—TEMPERING IRON.

July 10, 1826.

GENTLEMEN;—I am a manufacturer of bar iron, and not having been long in practice, I find that the finers have made a quantity of iron which is too hard and not equal in softness all through; some bars have hard places, which break away when under the operation of fluting. I should feel very much gratified if any of your valuable correspondents would inform me what way would be the best to make this iron *soft* and *equal*, and also an operation to make the iron *as soft as possible* in the fining, because for some purposes it cannot be too soft. Our mode of manufacture is to sink the scraps with charcoal, and then hammer them into billets or blooms; after that, they are heated in the air-furnace, and rolled into bars.—I am, Gentlemen,

Yours obediently,

E. Y.

No. 45.—FLOORING.

Suppose it is required to cover the top of a square tower, the side of which is 18 feet, with a floor, and that the only timber to be procured is four pieces as joists (and boards), each 12 feet long. How can this be accomplished, so that the floor, which can have no upright timber under it to bear any part of the weight, may be the strongest possible, and perfectly level? G. W.

No. 46. FLAVOURING BRANDY.

By what process is *brandy* flavoured?

MICQ.

PAINTING ON VELVET.

Among the French List of New Patents, there is one to a M. Vauchelet, for a new method of painting on silk and cotton velvet. The following is the specification:—

"Extend some tracing paper (*papier lucidonique*) upon the object to be copied, and trace the design upon it with a pencil. Rub the contrary side of this paper all over with fine lac in powder, and apply this reddened surface upon a smooth piece of parchment. With a pencil go over every object separately, using as many pieces of parchment as there are different objects and different colours in the design, so as to transfer every object on a different piece. Afterward cut out all the pieces of parchment by the transferred lines; and, this done, extend the piece of velvet intended to be painted upon a table covered with a green cloth; place every piece of parchment, one after another, on that part of the velvet where the portion of the drawing ought to be which has been cut in the piece of parchment; and with a pencil charged with a colour suited to that part of the drawing, go over the velvet where it is not covered by the parchment. The same is done for each piece of parchment separately, till the whole drawing is completed.

"The execution of this process requires a great deal of care and attention, in order to avoid obliterating the design, for the whole is performed continuedly, without waiting for the part which has been just painted to be dry, before commencing another. At last the parts which may not have taken well, are corrected and finished with a pencil, or by means of new pieces of parchment.

"*Preparation of the oil used in this kind of painting.*

"I grind into very fine powder 20 grains of sal-ammoniac, and 20 grains of sal-prunella. I throw this powder into one pound of the clearest linseed-oil that can be obtained, and boil it for three hours.

"One hour before taking the oil off the fire, I put into it a piece of soft bread, which I have carefully soaked in oil of vitriol, and three large onions cut in pieces.

"When this bread is almost calcined, and the onions are dissolved, I take off the oil, and strain it through a new piece of coarse cloth. I put it afterward into bottles, and use it for grinding the colours as I require them for painting, observing to employ it with management, that the ground colours shall not run on glass, but have the consistence of butter.

"This oil does not spread on the velvet beyond the outlines of the drawing."

WASH FOR FRUIT TREES.

Mr. Braddick, a Fellow of the Horticultural Society, states, that amongst the many *washes* which he has employed for the destruction of insects on fruit trees, he has met with none so effectual as the water through which the coal-gas is passed, for the purpose of purifying it. Its extremely fœtid smell led him to think that no insect could resist its influence, and in this he has not been deceived. He mixed one pound of flower of brimstone in three gallons of gas-water, and added soft-soap enough to make it adhere to the buds and branches when laid on with a painter's brush; the composition may be mixed over fire with safety, as it is not inflammable. It is important to those who wish to try the experiment to know, that it does no injury to the trees; with Mr. B. it has been fairly tried under glass, on the most delicate of all trees (the flat peach of China), which is now breaking into full leaf with great vigour.

ARTIFICIAL BEES'-WAX.

The Asiatic Journal contains a notice of a discovery in India, of a method of manufacturing a substance, to which has been given the name of artificial bees'-wax. It is intended as a substitute for the natural wax in the manufacture of candles. It is formed by a curious and ingenious process from vegetable oil. Candles made of it are little if at all inferior to those made of common wax, while they may be afforded at a much cheaper rate than even the coarsest of the ordinary kind.

SIMPLE ARITHMETICAL RULES.

To multiply any number by 5.

Add one cipher to the number, and divide by 2.

To multiply any number by 25.

Add two ciphers to the number, and divide by 4.

To multiply any number by 125.

Add three ciphers to the number, and divide by 8.

To multiply a number by any number of nines.

Add as many ciphers to the multiplicand, as there are figures in the multiplicator; then subtract the first given multiplicand from the increased one: thus, 88×999=88000

88
87912

CHINESE LIFE-PRESERVER.

It may be useful to swimmers and sailors at this season of the year, to acquaint them with a very simple preservative against drowning, employed by the Chinese. It consists of four pieces of bamboo, about the length of a man each, placed transversely and parallel, two and two, with a hole sufficient to let the head and shoulders through, and then tied securely. When the arms are extended, there is no danger of sinking.

It must be observed, that bamboos for this purpose are sometimes four inches diameter; but deal will equally well answer, provided it be about the size of a man's arm in thickness.

ADVANTAGES OF CANALS.

M. Dupin, in an able article which he has contributed to the first Number of the *European Review*, on the means of communication which Great Britain possesses from inland navigation, makes the following remarks:—

"Persons who allow themselves to be seduced by ingenious paradoxes, admire the definition given of rivers by Montaigne, who calls them *roads which travel*. They are in ecstacy respecting the advantages of thus having roads which travel! but this advantage, real in fact when in the direction of the current, becomes a serious inconvenience when proceeding in a contrary direction. Thus, taking every thing together, it becomes more preferable to improve the means of travelling upon tranquil waters than upon tide-streams.

"The English are now convinced of this great truth, which the celebrated Brinkley, the engineer of the Duke of Bridgewater, was the first to demonstrate to them by his precepts and his works. This able engineer, when called before a Committee of the House of Commons upon the subject of a canal, which it was proposed to carry into effect, strenuously maintained the utility of the project, notwithstanding the proximity of a river, which seemed to render superfluous all artificial navigation. 'For what purpose, then, do you imagine,' said a member of the Committee to him, 'has Providence created those numerous and beautiful rivers with which England is blessed?' '*It was*,' answered Brinkley, '*to feed the canals*.'

"I venture to affirm, that this bold but just thought will, by degrees, surmount the prejudices which at first sight repel it, and that ultimately it will be triumphant amongst all industrious and enlightened nations. In those countries where commerce and the useful arts flourish, canals will be, sooner or later, established by the side of the different natural currents of water, of which the progress is irregular and rapid."

STEAM-PROOF CABIN.

A citizen of Maryland has invented a steam-proof cabin for steam-boats, which will effectually secure the passengers in the cabin from injury, should an explosion or forcing of the heads of the boilers take place.—*American Paper*.

NEW PATENTS.

To Benjamin Black, of South Molton-street, in the parish of St. George, Hanover-square, Middlesex, lamp-manufacturer, for his improvement on carriage-lamps.—26th May—6 months.

To James Holland, of Fence House, in the parish of Aston, Yorkshire, shoemaker, for certain improvements in the manufacture of boots and shoes.—31st May—2 months.

To John Heathcoat, of Tiverton, Devonshire, lace-manufacturer, for certain improvements in the methods of preparing and manufacturing silk for weaving and other purposes.—15th June—6 months.

TO CORRESPONDENTS.

Mr. G. G.'s description probably in our next.

T. M. B. will oblige us by sending the description he mentions.

Communications received from Mr. Jennings—A. H. R.—R P. B.—Circulus.—H.—Odiadeps—T. I. S.—Mr. Marst,—W. H. P.—I. I.—P. V.—Rose Collin—Novitatis Avidus—Mr. Shenton—Mr. Gilman—Aurum—James Collins—A Goldsmith's Apprentice—W. M.—James Cook—Bear and Ragged Staff—Lover of Improvements—A Vellum Binder's Apprentice—Tempus.

Communications (post paid) to be addressed to the Editors, at

THE PUBLISHERS,
KNIGHT AND LACEY,
55, *Pater-noster-Row, London.*

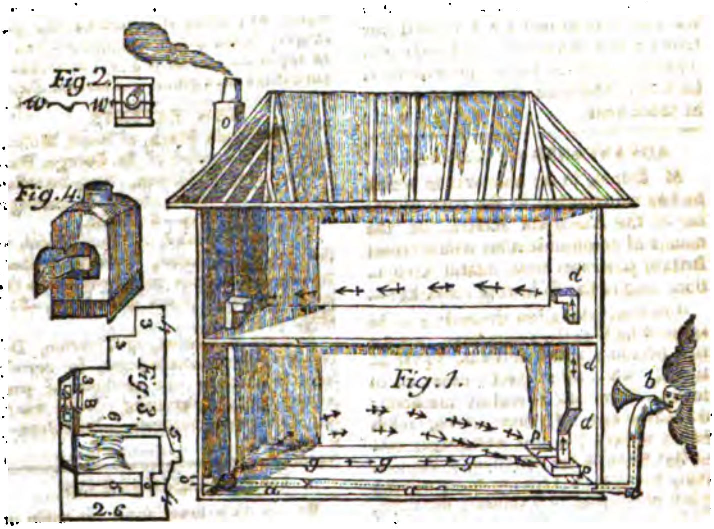
T. C. Hansard, Paternoster-row Press

Mechanic's Magazine,

Museum, Register, Journal, & Gazette.

Commerce is the true philosopher's stone so much sought after in former times, the discovery of which has been reserved to genius, when studying to improve the mechanic arts. Hence a pound of raw materials is converted into stuffs of more than fifty times its original value; and the metals too—it is true they are not converted into gold; they are more,—for the labour of man has been able to work the baser metal, by the ingenuity of art, so as to become worth more than many times its weight in gold.—*Dr. Lewis.*

No. 49.] SATURDAY, JULY 31, 1824. [Price 3d.



IMPROVED METHOD OF WARMING AND VENTILATION.

Silk Mills, Winchester, May 5, 1824.

GENTLEMEN;—Though you have occasionally favoured your readers with descriptions of methods of warming and ventilating buildings, I have ventured to send you one other, the principal advantage of which is, that it is applicable to warming a ground-floor where there is not a cellar underneath, and yet introducing hot air at the BOTTOM of the apartment, which is certainly more beneficial than at two or three feet above the floor. This method has been in actual use at my manufactory, at Kings Sumborne, Hants, and has answered its purpose admirably. The building consists of two floors, each 45 feet by 15, and 7 in height. The whole expense for stove, case-pipes, trunks, flues, and labour, did not exceed 15*l.*; the lower floor is brick.

Description of the Drawings

a a a, the line of a flue so far below the floor, that the bricks composing the same form the top; within this flue lies horizontally (and proceeding from the stove to the chimney at *o*) the smoke-pipe *x x x*, made of sheet-iron, and shown in section at fig. 2; it is supported by wire laid in the joints of the brick-work, as *w w*, fig. 2. This pipe made hot by the smoke, &c. passing through it, gives heat to a current of air introduced from outside the building, and forced in by a turn-cap *b*, which always *faces* the wind. After the air is warmed by passing in contact with the hot smoke-pipe, it escapes at the circular plate *c*, and warms the lower room; it then proceeds in the direction shown by the arrows towards the stove-pit, into which it descends, and rising again between the stove and iron case, proceeds by the trunk *d d d*, to the upper room; it then, after having performed its duty, descends by the cold air trunk *f*, and into the cold flue *g g g*. This flue is level with the ash-pit 1, (fig. 3), where its entrance is shown at 2 2; and thus is the impure air brought to and consumed by the fire, the whole quantity necessary for combustion being supplied by the trunk *g g g*, which opens in the upper room at *f*. The stove is a square cast-iron one, inclosed within a sheet-iron case, leaving a space between the two of 3 inches; it stands in a pit, *p p*, about 2 ft. 6 in. deep, at the end of the room opposite the chimney. A section of the pit and stove is shown at fig. 3. 3 3 3, steps to descend to feed the fire; 4 4, level of the floor; 5 5 5, iron case; 6, door to ditto, which is made large, and when opened, enables the attendant to open the stove-door 7, and feed the fire: 1 is the ash-pit, and 8 an opening with cover to withdraw the cinders, &c.; 9, the smoke-pipe. Fig. 4 shows the door and case.

To apply this to warming a ground-floor, only remove the trunk *d d d*, and make an opening in the middle of the floor to communicate with the cold-air flue *g g g*, stopping also the entrance *f*. In summer, cold air will be supplied instead of hot; but there should then be an opening into the chimney near the ceiling of the upper room for the *foul air* to escape, there being no fire to consume it as in winter.

W. K. Shenton.

LONDON MECHANICS' INSTITUTION.

To the Editors of the Mechanic's Magazine.

July 26, 1824.

Gent.;—I trust to your candour for an early insertion of the following remarks on your account of what passed at the London Mechanic's Institution, on Friday the 16th instant, after the Mathematical Lecture, and in answer to Mr. Conway's letter, published in your Magazine of last Saturday.

The main objection to the proceedings in question is, that the Committee had no power to call a Special General Meeting of the Members of the Institution; and you say that their having done so was, in some sort, admitted to be a fault; I agree that it was, but I cannot help thinking without the least occasion. You say that "the laws state expressly that there shall be but four General Meetings in the course of the year." Upon this statement we are at issue. You allude to the 86th law, which, copied word for word, is as follows: "There shall be Four General Meetings of the Institution in every year." If it had said, there shall be *but* four, or four *only*, I grant the Committee would have been left without defence. But I take leave to say, that an absurdity so gross could not possibly have been contemplated, either by those who framed or those who passed the law, as to deprive the Committee of Managers of the power to consult their constituents whenever it might appear desirable to ascertain their wishes or obtain their sanction.

In judging of what a law allows or forbids, we must not overlook entirely its spirit and obvious intention; and the clear meaning of this law is, that there shall be Four General Meetings of the Members at the *least*, and not at the *most*. The law makes it imperative on the Committee to afford the Members at large four several opportunities of expressing their opinion on the conduct of the persons entrusted with the management of their affairs, but could not intend to prohibit their consulting together oftener, when it is plain the best interests of the Institution might occasionally require it.

I think, Gentlemen, you pass over too lightly the observation of Mr. Stacy, respecting law the 33rd, which says, "The Committee of Managers shall have the care, superintendance, and control of the Institution." It seems to me a strange thing, and difficult to imagine, hat the managers, curators, and superintendants of an Institution should not possess a power at once so simple, so useful, and so necessary, as that which might enable them to summon a meeting of its members.

It appears to me, therefore, that your objection to the legality of the Meeting, however conscientiously, was inconsiderately put forward; but I cannot approve of the warmth with which it was met by one or two who spoke against it. It is absolutely necessary that any proposition, let its nature be what it may, or however adverse to the views of the Committee, should be fairly met and respectfully entertained. I am confident the good sense of the different members of the Committee will point this out to them as a course never in future to be deviated from.

I differ from you entirely with respect to the objection that proper notice of the intended meeting was not given. You make the case a little stronger by stating that it was announced only on two preceding lecture nights, instead of three, which was actually the case.* Let us judge of this matter by the effect; you will acknowledge there was a full attendance of the Members, much larger than at the General Meeting in June regularly convened, and that, too, on a Friday night, when in general they are far from numerous. If, therefore, the Meeting was intended to be convened in a clandestine manner, it wholly failed of effect, and was, indeed, a most bungling performance.

I do most sincerely believe, that throughout this whole business the Committee have been actuated by no motive so strongly as by that of doing their duty to their constituents. They find a place fitted, in their opinion, from situation, and in other respects, for carrying into effect all the objects of the Institution; and their next step is to ascertain, by the most simple mode, whether the Members at large were disposed to agree with them as to the eligibility of their choice.

I should like to make a few observations on the editorial remarks which closed your account of the Meeting, but that I should thereby extend this letter to an inconvenient length, and that it is more my object to allay differences than to find subjects for dispute.

I beg to say before I conclude, that I make these remarks as a member of the Institution, and only in that character interested in the conduct of the Committee, to no one individual of which, save the worthy President, am I personally known. I can also safely say, that I have no motive for addressing you—no feeling beyond what results from an earnest desire to promote the common interest. My efforts may be feeble; but I am sure they are well-intentioned and disinterested, upon the strength of which two last qualities I beg to recommend them to the indulgent attention of my brother mechanics.

Your most obedient servant, B. T.

* So we understand.—*Edit.*

[We give, with much pleasure, immediate insertion to this candid, temperate, and well-written communication. It meets the arguments on the case fairly, and does not, like other letters we have received, endeavour to blink the question by coarse abuse or ungenerous insinuation. In the same spirit, we reply, that though the laws do not declare that there shall be "but four and *no more* General Meetings of the Institution" in the course of the year, yet by their *not* providing *how* any more meetings are to be called—*not* directing *what length of notice* shall be given of extra or special meetings, nor *in what manner* that notice shall be given—it appears to us a matter of clear inference, that it was *not intended* to give, in any shape, authority for such meetings: and we may add, as a matter of *fact*, though not of *record*, that it *was actually intended to withhold all such authority* (however extraordinary it may seem), because of the settled conviction of several individuals of great intelligence and (alleged) experience, employed in framing the laws, that Four General Meetings in the course of the year were quite sufficient for every good purpose. Our statement on this point will the more readily receive credence, when we frankly acknowledge that we were of the few who thought that there should be as few obstacles as possible thrown in the way of the Members meeting in General Assembly as often as there is occasion; and when we state farther, that *but* for the opinions we entertained on this point—*but* for the too common practice of *dividing differences*, as it is called—the Members of the London Mechanic's Institution would, in all probability, have only had *two* instead of *four* opportunities in the course of each year of inquiring into the conduct of their Managers. We are far from saying that we have changed our opinion on this point; nay, we agree perfectly with our correspondent, that the Committee ought to have the power of consulting their constituents *at all times* when the interests of the Institution require it. But till the laws are altered, no one can dispute that they ought to be rigidly respected; there can be no medium between obeying them entirely and not obeying them at all: suffer a single invasion of them to pass, and you will have one invasion after another, till they are no longer of the smallest avail for protection or security. When they are altered, moreover, so as to give the Committee this salutary power (which we hope will be ere long), it will most assuredly be accompanied by such regulations as will ensure all proper publicity being given to every Special Meeting the Committee may call. It is an *indispensable quality* of the General Meetings of all public bodies, that they shall be so advertised or intimated, that every member may have an opportunity of attending, and none have room to say afterwards that he knew nothing of them. Had the Special Meeting attempted to be got up on the 16th inst. been otherwise legal, it would have been still grossly defective in this respect. It was not announced in such a way that every Member could be reasonably supposed to be acquainted with it. We know of many who, like ourselves, only heard of it by the merest accident, and we know of others who never heard of it at all. We acknowledge that the Meeting was, as our correspondent states, much larger than the regular General Meeting in June; but how does that affect the principle involved in the case? A meeting may be numerous enough, which consists only of individuals all on one side; and yet essentially irregular and incompetent, because those on the other side were not apprised that it was to take place.

We have felt ourselves the more strongly called upon to uphold the Laws of the Institution on this occasion, because we have reason to fear it is, *in reality*, but the precursor of other innovations of a still more dangerous description, all connected too with the castle-building schemes of the Committee, which the Members will shortly be called upon to resist with all their might. It may be sufficient, for the present, to remind those who meditate these innovations, that there are such provisions in our Laws as those contained in Articles 47 and 72. Perhaps this hint may yet suffice to make them respected.

It is with unfeigned sorrow that we are thus obliged to set ourselves in opposition to the proceedings of the Committee; for of that body, generally, we feel bound to say, that it contains, in our opinion, as many persons sincerely disposed to do well as any body of equal numbers that ever existed; and for several individuals in it we can never entertain other than sentiments of the highest respect and esteem.

But the interests of the Institution are, with us, above all private or personal considerations. If we have erred at all, it has been in remaining too long silent, under a conviction which has of late forced itself and grown upon us, that the objects of the Institution are not promoted as they ought to be. We have been *slow to blame*, because our liking is to commendation; nor have we at last spoken out till after availing ourselves to no purpose of many a private opportunity of awakening the Members of the Committee to a proper sense of the line of conduct they should pursue. *Quiescent* we could remain no longer, because we felt conscientiously convinced that we should be thereby only encouraging the Members in a most pernicious delusion, and destroying every chance that yet remains of accomplishing the great objects proposed by the Institution.

How far it has hitherto disappointed the hopes entertained of it, will best be seen by comparing what it has done with what another Mechanic's Institution, established not long before it, has accomplished.

The Glasgow Institution, which fairly claims to be considered as "the parent and the pattern of all similar institutions over the world," was established in July, 1823. In *less than three months* it possessed a library of upwards of 1,300 volumes, of which the Members had the use; in *less than six*, it had a Hall, which is described as "the most extensive and commodious Lecture Room in all Glasgow;" and ere nine months had elapsed, it had commenced the formation of a Museum, which is already of considerable value: all these things, too *(besides paying all their Lecturers)*, the Glasgow Mechanics take a just pride in saying, "they have done without the slightest aid asked or obtained from the public."

The London Mechanic's Institution has been established about seven months. It has been presented with several sets of books (not, we believe, 200 volumes in all), but it has *as yet no library accessible to the members* at large; nor has a single step been taken to admit them to the use of the few books which were intended for their benefit by the donors; neither has it any Hall—only a couple of handsome chambers in an Inn of Court, for which it pays more than the Glasgow Mechanics do for their extensive and commodious Lecture Room (though rents in London and Glasgow are nearly on a par); as little has it any Museum, or the appearance of speedily possessing one: and all these things it still wants, though its Managers have *paid nothing* to any of the Lecturers hitherto employed (rather forgetful it would seem of those principles of independence on which the Institution originally professed to proceed*), though both the public and the Members have contributed liberally to the funds of the Institution, and though there are, at this moment, several hundred pounds lying idle in the banker's hands, for no other reason than that we may, some day hence, have a fund to support a grand house, for which (if things go on as they are doing) there will be but little occasion.

We have no other object, God knows, in thus pressing the wants of the Institution on the attention of the Members than to cause them to be promptly and effectually remedied. Its prosperity must naturally be ever one of the first wishes of our heart. We will not conceal that we have received several letters imputing to us motives of a very different description; it is said, "that the approaching election explains all." It must suffice, however, to extinguish for ever the ungenerous insinuation here conveyed, when we declare, as we now do, that so far from having any personal object to gratify beyond that of preventing an institution which we had some share in forming

* "Of that part of your proposal which relates to the contributions of mechanics, I do entirely approve. Whilst Science was to them of *doubtful value*, it might be offered, as was formerly the case, *gratuitously*. But its worth, in the most mercantile exception of the word, is now *indisputably established;* and it is right, in order that it may be fully estimated, and in its possession be *unaccompanied by any feelings of dependence, that it should become their own by purchase*."—*Letter from Dr. Birkbeck to the Editors of the Mech. Mag.* [See Vol. I, p. 115.

from falling to decay, we have already declined to be put in nomination (the Laws require the consent of the nominee) for the next election; that we do not anticipate the possibility of any circumstances arising to make us alter the resolution we have formed in this respect; and that we will not, either directly or indirectly, be the means of putting a single friend or acquaintance in nomination for the direction.

In *one sense*, the approaching election does help to "explain all." It adds another and a very strong reason for the Members being called on to bestir themselves at the present moment; for it is only by their taking advantage of the next election, to infuse some new life, vigour, and intelligence into the management, that there is any prospect of our Metropolitan Institution yet attaining that pre-eminence among establishments of the kind which it ought naturally to hold, and which it is of so much importance, in the way of example to the rest of the kingdom, it should possess — *Edit.*]

ANALYSIS OF CONTEMPORARY SCIENTIFIC JOURNALS.

Literary Journal of Science, Literature, and the Arts, Nos. XXXIII. and XXXIV.

(*Concluded from page* 278.)

Effect of Magnetism on Chronometers.

The power which a magnetic force possesses of accelerating the rate of a time-keeper in some situations, and of retarding it in others, is a fact which has been verified by many interesting and important experiments. A pocket chronometer, having a very steady and uniform rate of + 20″ 4, was placed with its main spring nearly in contact with the magnet, and with the magnetic power directed through its centre, when the rate altered to + 65″ 1; but on moving the centre of the main spring 90° from the preceding position, so as to cause the magnetic power to be transmitted through the centre of the balance, the rate immediately declined to — 23″ 2; and on turning the time-keeper another quadrant, so as to remove the centre of the main-spring 180° from its first situation, the rate again rose to + 43″ 4; and when, through another quadrant, the attractive force being in this situation transmitted nearly through the centre of the balance, the rate became — 2″ 6; and on restoring it to its first position, + 72″ 7.

When the time-keeper was detached, its rate returned to + 18″ 2. Similar experiments with another chronometer, having a detached rate of — 2″ 0, produced, in situations correspondent to the last, the rates + 10″ 0, + 3″ 1, + 5″ 0, and — 1″ 1.

It is singular, however, that the same attractive power which, when applied in different directions to one chronometer, tends either to accelerate or retard its rate, should in another, when allowed to operate under the same conditions as to intensity and position, produce results precisely the reverse.

M. Harvey, whose experiments on the effects of the density of the air on chronometers we have already noticed (p. 275), has also directed his attention to the present subject, and produced an ingenious paper, in which he explains that these apparent anomalies are owing to *the varieties of imperfect isochronism* almost necessarily existing among different chronometers; that is to say, the varieties in the vibrations of the balance. Mr. H. doubts whether a chronometer ever existed in which the adjustments of the spiral spring were such as to admit of its elastic force varying precisely with the arcs of vibration, while it is a fact that these arcs vary according to the direction in which the magnetic influence is applied; and though he shows how the deviations from perfect isochronism produced by the magnetic influence may be *calculated*, he has not been able to suggest any remedy for them.

Improvement in Microscopes.

Compound microscopes, when constructed on the common principle, are generally so full of fog as to be very inefficient, especially for the examination of opaque objects, which render this defect more striking than transparent ones. Dr. Goring conceives that the fault results from the custom of making the object-glass of a very small aperture, instead of giving it a larger one, and placing the stop in the wrong place; and he thus proceeds to introduce an improved construction, by which it may be remedied:—

"If we form a microscopic object-glass of a single lens of considerable aperture, having a stop in its focus of about the same diameter as the apertures of the common lenses used for compound microscopes (that is to say about one-tenth or one-twelfth part of their focal distance), we shall form an object-glass which gives a clear image, free from fog indeed, but very deficient in other respects; for the stop being placed *where the rays cross each other*, a large portion of the aperture of the lens is called into action in comparison to what is usually made use of when it is at once limited by a stop of the same diameter applied close to the glass; the aberrations both chromatic and spherical are here immediately felt; to remedy these, another lens must be employed, the best position for which is close to or very near the farther side of the stop. The focus of it must be to that of the first as 3 to 2, or as 2 to 1; for low powers, however, it may be about 2½ to 2; for the higher the best proportions seem to me to be as 2 to 1. The lenses employed should be plano convex, having their curves towards each other.

"These object-glasses I can recommend as greatly superior to those in common use; they are bright, clear, and distinct, free from spherical aberration, and will show no sensible colour with opaque objects of any kind, not even with so trying an one as the enamelled white letters on a black ground, generally used by opticians to try their telescopes with."

Dr. Goring admits, however, that the common object-glass is still the best for high powers—for those of a quarter of an inch focus and upwards "I had fully expected," he says, "that the same principle applied to deep object-glasses, would form as superior an object-glass for high powers as for low ones; however, the reverse is the fact; it is one of those things which can only be learned from experience, and could not have been predicated *à priori*."

Telescope Magnifier.

Dr. Goring, in a note to the preceding paper, says, "It will be obvious that a microscope of my construction may be used as a magnifier for a telescope. In fact it is in its principle nothing but the four-glass erecting achromatic eye-piece of a day-telescope a little modified (there is, alas! nothing new under the sun). Indeed, many of Mr. Tulley's astronomical telescopes are so constructed, that the night-eye pieces can be applied to magnify the erected image formed by the two glasses which do the work of my object-glass. It would, however, be much better, instead of increasing the depth of the eye-glasses in this case, to augment that of the erecting part, as a much sharper image is in this way obtained. There certainly are many objects which are seen better with this kind of eye-glass, such as Venus, and many double stars: the number of refractions arrest a portion of the false light or halo which so commonly surrounds these objects. However, the same, or nearly the same, effects seem to be produced by diminishing the aperture of the object-glass of the telescope, except that this seems to increase the spurious disc of the fixed stars, which the other does not. Many suppose that great advantages are to be gained by making a microscope with a long tube and a shallow eye-glass. I have satisfied myself repeatedly by experiment, that, whether the required magnifying power is obtained in this way, or by a short tube with a deep eye-glass, the effect is precisely the same. The body of my microscope is seven inches long, having an achromatic eye-piece of about one inch negative focus just like those applied to telescopes. I do not like the double and triple eye-glasses very commonly applied to microscopes, as they are apt to give double images, with luminous transparent objects."

Preparation of Caoutchouc.

Mr. T. Hancock is stated to have succeeded, by some process, the results of long investigation, but which he has not published, in working caoutchouc with great facility and readiness. It is cast, as we are informed, into large ingots or cakes, and being cut with a wet knife into leaves or sheets about one-eighth or one-tenth of an inch in thickness, can then be applied to almost any purpose for which the properties of the material render it fit.

"The caoutchouc thus prepared is more flexible and adhesive than that which is generally found in the shops, and is worked with singular facility. Recent sections made with a sharp knife or scissors, when brought together and pressed, adhere so firmly as to resist rupture as strongly as any other part; so that if two sheets be laid together and cut round, the mere act of cutting joins the edges, and a little pressure on them makes a perfect bag of one piece of substance. The adhesion of the substance in those parts where it is not required, is entirely prevented by rubbing them with a little flour or other substance in fine powder. In this way flexible tube catheters, &c. are prepared, the tubes being intended for experiments on gases; and where occasion might require they should sustain considerable internal pressure, are made double, and have a piece of twine twisted spirally round between the two. This, therefore, is imbedded in the caoutchouc, and at the same time that it allows of any extension in length of the tube, prevents its expanding laterally.

"The caoutchouc is, in this state, exceedingly elastic. Bags made of it, as before described, have been expanded by having air forced into them until the caoutchouc was quite transparent; and when expanded by hydrogen, they were so light as to form balloons with considerable ascending power, but the hydrogen gradually escaped, perhaps through the pores of this thin film of caoutchouc. On expanding the bags in this way, the junctions yielded like the other parts, and ultimately disappeared.

"When cut thin, or when extended, this substance forms excellent washers, or collars for stop-cocks, very little pressure being sufficient to render them perfectly tight. Leather has also been coated on one surface with the caoutchouc, and without being at all adhesive, or having any particular odour, is perfectly water tight."

We here close our selections from the Numbers of the *Quarterly Journal* before us, having regard in these to the practical instruction our readers are likely to derive from them; but the Journal contains besides, several papers of great theoretical value, particularly those under the head of Astronomical and Nautical Collections, on the Theories of the Tide and of Magnetism, as also some clever Reviews of New Scientific Publications.

LIGHT AND VISION

Gentlemen;—In vol. I, p. 252, of the Mechanic's Magazine, a correspondent mentions his intention of allowing the name of Sir Isaac Newton the enjoyment of an immortality of a hundred years before he destroys it, by bringing forward a perpetually moving machine of his own invention. Sir Isaac never having devoted his attention to this *profound* subject, had the temerity to pronounce it unattainable. I entreat this gentleman to lay aside his delicacy, and let us have the benefit of his *well-directed* labours at once; for he cannot destroy that which has ceased to exist. To come to the point—Sir Isaac has had his day: his hypotheses have answered the purpose reasonably well, till, in the progressive march of the human mind towards intellectual perfection, some more simple and sufficient explanation of the phœnomena of nature could be brought forward. That time has now arrived; and as the ancient Grecian peasant voted for the banishment of Aristides because he was so provokingly popular, so must it afford infinite pleasure to many wiseacres besides myself to find Newton (whose name can never be mentioned but "the great," "the wise," or "the good" must needs be prefixed to it) tumbled from an elevation which has so long been blindly accorded to him by universal suffrage. In page 186, vol. II., there is a most edifying paper upon light and vision, which gives a most satisfactory explanation of the phenomena appertaining thereto. It is there proved to *my* satisfaction that external light is useless, and therefore does not exist, and that the colours of objects, and sunshine and shade, have no existence but in the mind.

Some of my friends, however, have teazed me with several puzzling questions, which I must thank Mr. Pasley to instruct me how to answer. "Why is the eye more fatigued by looking upon an object which produces the idea of white, than when looking upon what is called black, if the pressure be greater in the latter case than in the former?" "What is meant by a ray, and its continuity from the prism to the eye?" "If this ray be not material, what is it?" "If immaterial, how can it possess continuity, and produce pressure in different degrees upon the organ of vision?"

I am, Gentlemen,
Your obedient servant,
NOVITATIS AVIDUS.

MR. GLADWELL'S IMPROVED PLANE.

Vauxhall, June, 1824.

GENTLEMEN;—Having the pleasure of seeing my name among those who were so highly honoured as to receive a reward from the hands of his Royal Highness the Duke of Sussex, voted by the Honourable Society of Arts, &c. for my simple improvement on the carpenter's plane (p. 204, Vol. II), and having also experienced your kindness by the insertion of the account of my skater's life-preserver n your valuable work, I am again induced to trouble you with a few lines respecting the improvement for which I received the reward. It consists in attaching soles or bottoms to planes to answer a number of different purposes, which the drawing will show.

Fig. 1

Fig. 2.

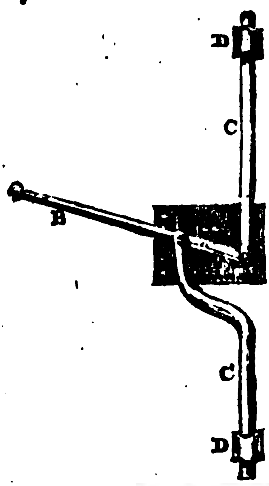
Fig. 1 is the smoothing plane fit for work, showing the joint of the sliding-sole attached. Fig. 2 is the sole turned on its edge, showing the dove-tail slip, which fits into a groove in the upper part of the plane, by which means as many different soles can be applied as the necessity of the work requires, either for compass or straight work. Planes on this principle will enable the workman to go to his labour with a less burden of tools than he has been in the habit of taking, besides producing a saving of 100*l*. per cent to an industrious class of mechanics, who are borne down with the expense of their tools. These planes may be had of Mr. Armour, plane-maker, N° 71, Strutton-ground, Westminster, whose tools in general I have proved, and found to be equal, if not superior, to any in London for beauty and soundness of work.

Your obedient servant,
G. GLADWELL.

IMPROVED DOOR-BOLT.

Newington Butts, March 20, 1824.

GENTLEMEN;—I have in use a bolt upon a very heavy door, of the description represented above, and find that it is much less troublesome to open or shut than any I ever met with, while at the same time it is equally secure.



A represents a square iron-plate fastened to the door; B, a lever working upon a nut between the points where the bolts C C also work upon nuts on the lever B, which being raised, lowers the upper bolt, and depresses the under one; D D are staples for the bolts C C to work through.

Yours, &c. R. W. D.

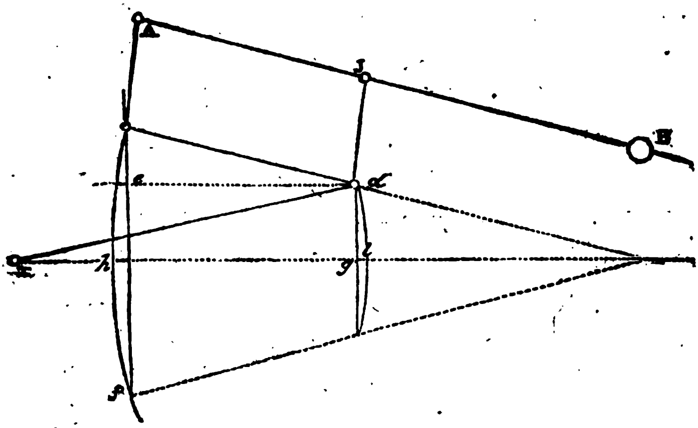
STEAM ENGINE RULES.

Tower, Jan. 6, 1824.

GENTLEMEN;—I was in hopes some abler correspondent would have noticed the "Questions to Engineers," p. 239, Vol. I, two of which yet remain unanswered.

I feel inclined to afford your valuable Magazine all the support in my power, and am therefore induced, in the absence of a better and shorter method, to annex you the following for finding the length of the radius rod.

The beam being given, length of stroke, and link, to find the radius rod $d\,x$:



$AB - c\,d = BJ$. As $AB : c\,f :: BJ : d\,k$, $\frac{d\,k}{2} = d\,l$, and $\frac{c\,f}{2} = c\,h$, $c\,h - d\,l = e\,c$. Assume the right angled triangle $c\,d\,e$; then $\sqrt{c\,d^2 - c\,e^2} = d\,e$, and $c\,d - d\,e = g\,l$, the versed sine; then $\frac{d\,l^2 + g\,l^2}{g\,l}$ = diameter of circle, half of which is the radius rod $d\,x$.

With respect to the mode of calculating the power of the steam-engine, which your correspondent "Gulielmus" states to be various, I believe there is only one acknowledged authority, the late Mr. Watt, who has been justly styled the "Father of the steam-engine." His rule for calculating was simply this:—multiply the area of the piston by the number of lbs. pressure on each square inch of its surface, and that product by the number of feet it has moved per minute, and divide by 33,000; the quotient is horses' power.

For example—take your correspondent "W.'s" question, p. 300, Vol. I, the cylinder of whose engine is 14 inches diameter; 2 ft. 6 in. stroke and 44 strokes per minute.

Here, then, we have the area = 153·93 × by 7 lbs. assumed pressure per square inch = 1077·51; × again by speed of piston 220 feet per minute, = 237052·20 ÷ 33·000 = 7, 18-horse power.

This engine must be lightly loaded, or its speed ill judged.

I am, Gentlemen,
Your subscriber,
HORATIO.

[This communication should have appeared earlier, but was unfortunately mislaid.—EDIT.]

MOULDING THE MITRES OF CORNICES.

To the Editors of the Mechanics' Magazine.

GENTLEMEN;—I have often wondered that the tedious, expensive, inaccurate, and unworkmanlike method of moulding the mitres of cornices by the eye and hand, has not been long since superseded, by so constructing moulds, that each member should be made to shift, or be prolonged, at pleasure, to the right or left, and fixed in its new position by some simple contrivance. In every case, except that of the form of the plaister impression *imprisoning* the mould, a mitre might then be almost, if not entirely, completed, and with the same accuracy as the rest of the work. Will not some clever carpenter among your readers rescue the builder's art from this blot?

I am, Gentlemen, yours, &c.

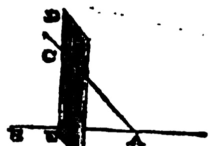
A Recent Builder.

MECHANICAL GEOMETRY.

(Continued from p. 265).

Problem 6.

To draw a line perpendicular to a given line, by means of a *mitre square* only.



Let B E A be any given line, and E the point from which we are required to draw a perpendicular.

From any point, as A, draw A C by means of a *mitre square;* then is the angle C A E a true mitre bevel: apply the instrument to the line A C, and slide it along till the edge D E corresponds to the point E; then is C E square, or perpendicular to A B, as was required.

Observation.---This very simple problem may, perhaps, be thought by geometricians; as of little use to the practical mechanic, as they are supposed to have an instrument at hand for the purpose of drawing lines perpendicular to each other; but it may so happen that the workman has either broken or mislaid his *square*, and then they will substitute for that instrument the one to which this problem applies; and thus I shall always endeavour to show how one instrument may be substituted for another, which plan I am sure the working mechanic will duly appreciate.

Definitions continued.

12. Planes bounded by four lines, are called quadrangles or quadrilaterals, and take different names, according to the angles the sides make with each other, whether right angles or oblique; and also, whether their sides are equal or unequal to each other.

13. A quadrangle, whose opposite sides are equal to each other, is called a parallelogram.

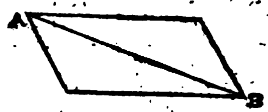
14. A parallelogram, whose angles are all right angles, is called a rectangle or oblong.

15. If the sides are all equal to each other, as well as all the angles right ones, it is called a square.

16. If the sides are all equal, but the angles not right ones, it is called a rhombus.

17. All other four-sided figures or quadrangles, are called trapeziums.

18. If a line is drawn from one angle to its opposite one, in any quadrangle, it is called a diagonal, as A B.



19. Planes bounded by more than four lines are called polygons, and take different names, according to the number of their sides; viz. a pentagon of five, a hexagon of six, a heptagon of seven, an octagon of eight, &c.

20. Polygons are called regular if their sides make equal angles with each other; if they do not, they are irregular.

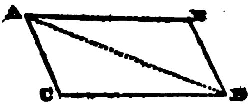
21. Figures are said to be similar to each other when their angles are respectively equal, and the sides about those angles in a certain proportion (or ratio, as geometricians term it) to each other.

22. Identical figures are those whose angles and sides are respectively equal, or, in the language of mechanics, they are those

figures which, if laid on each other, correspond in all their dimensions.

THEOREM VII.

The diagonal of any parallelogram divides it into two triangles, which are equal and similar to each other, or into two identical triangles.



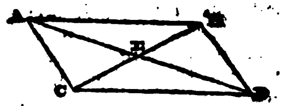
Let A B C D be any parallelogram, and A D the diagonal: we have to show that the triangle A B D is equal and similar (or identical) to the triangle A C D. Let the parallelogram be drawn and cut out in wood, card, &c., and divide it into two parts by the line or diagonal A D; it will be found that the two triangles, when laid on each other, will correspond in all their dimensions, viz. the angle C corresponds to the angle D; and D C being equal to A B, and A C equal to B D, the triangle must necessarily be alike.

Corollary 1. Hence we see that when two or more triangles have an angle in each equal, and also the two sides that form that angle equal (in each triangle) to each other respectively, the triangles are then identical, and that, therefore, the other two angles, and the third side in each triangle, must be equal to each other, as geometrical language says, *each to each*, that is, respectively, or that they will correspond in all their dimensions when laid on each other.

Corollary 2. Hence the opposite angles of any parallelogram are equal each other, as angle B equal angle C, and angle D equal angle A.

THEOREM VIII.

The two diagonals of any parallelogram cross each other in a point which divides each diagonal in two equal parts, or, in the language of geometry, the two diagonals bisect each other.



Let A B C D be the parallelogram, and A D and B C the diagonals crossing each other in the point E: we have to show that C E is equal to E B, and A E equal to E D.

Cut the parallelogram into four parts, from A to D, and from B to C, and we shall evidently have four triangles, and by applying E D of the triangle C E D to the side A E of the triangle A E B, we shall find them both of the same length; the same may be done with the side C E, and the side EB, and also with the other two triangles A E C and B E D. Hence we see that C E is equal to E B, and D E equal to E A, or that the diagonal C B divides A D into two equal parts, and the diagonal A D divides C B also into two equal parts, as was required to be shown.

Corollary 1. Hence the two diagonals divide the parallelogram into two *pairs* of identical triangles; viz., C E D identical to A E B, and A E C indentical to E B D, the truths of which will be evident by laying the triangles on each other.

Corollary 2. Hence also if one angle of a parallelogram is a right angle, all the other angles will also be right angles, and in that case, the diagonals will be equal in length to each other.

Note.—This last corollary is the basis on which is founded the common operation so well known amongst workmen, of trying whether a frame, &c. is square by means of extending a lath from corner to corner, which, if found equal, they rest assured the work is true. But I am sure the working mechanic will excuse me if I point out the fallacy of this common proof used amongst them; for though we admit the second corollary is strictly true, yet we cannot say that if the diagonals are equal, the figure must necessarily be a parallelogram, much more a rectangle, as the following problem will sufficiently show. G. A. S.

(*To be continued.*)

THE STEAM SOLDERING MACHINE.

Soho, Westminster, July 21, 1824.

Gentlemen;—I see, in No. 47 of your Magazine, a few observations on my "soldering machine," and have to thank you for the refutation which you so promptly annexed to them.

R. M. says, that no one could have thought of increasing the intensity of heat by steam. Now, I should like to know who told him that I sought to increase the intensity of heat by this machine. My aim was *not* intensity of heat; it was merely to lessen the labour of soldering by the lungs, which is so destructive to the health. From what he says in the concluding part of his letter, I infer that, in his opinion, the steam will *blow the flame out*. If the hole in the pipe were as big as the flame, most assuredly it would blow it out; but who ever saw a blow-pipe with an aperture of that magnitude? When the objections of R. M. came to be discussed in the shop where I am serving my time, we resolved immediately to put their validity to the test of experiment.

The question was, whether steam being of a moist nature, would act as wind. To prove this, the kettle was half filled with water, and put on the fire to boil; one of our blow-pipes was then pressed into the mouth of the tea-kettle, and bound close at the joint to prevent the steam escaping. As soon as the water boiled, a soldering lamp was put to the blow-pipe, and the effect was, that the steam acted upon the flame the same as wind. If R. M. has still any doubts on the subject, the experiment is easily tried; he may get a blow-pipe for sixpence or ninepence at any jeweller's tool-shop, and with the aid of his own kettle, obtain ocular demonstration of the fact.

Objections to my machine I expected to see, but of a very different kind to those offered by R. M. It might be said, for instance, that a man in a small way of business could not afford the expense of the fire which is required to heat the heaters. Granted; but wherever that expense is an objection, the heater might be done away with altogether, and the following arrangement substituted: set the urn on three legs, with a fire underneath, and make a conical passage through the urn; by this means, and with a few holes in the grate, I think a draught would be caused, that would keep the fire always burning, if properly attended to. For the regulation of the steam, I would propose a damper passing through the fire and the urn, which, undoubtedly, would answer the same purpose as drawing the heater up and down. The blow-pipe might also be made to put on or take off at pleasure, so that different sizes might be applied.—Your constant Reader,

A Goldsmith's Apprentice.

[Our young friend will excuse us for the abbreviations we have thought it necessary to make in his letter. R. M. is very well answered, without the help of any personalities.—Edit.]

PRESERVATION OF COPPER ON SHIPS' BOTTOMS.

Medical application of the Principle—Economy of substituting Iron for Copper.

Chatham Dock-yard.

Gentlemen;—The very ingenious plan of Sir Humphry Davy, to prevent the corroding effects of sea-water on the copper sheathing of ships' bottoms, cannot fail, it is presumed, of being of the first-rate utility and saving to the public. It is at once an elegant experiment, and a most happy application of the result of experience, observation, and talent.

Gentlemen, as every physical truth, when newly brought to light, or when applied in a novel way, is productive of new ideas, I beg to trouble you with one which the foregoing has created in my mind, and which, if founded in fact, may cause galvanism, in the hands of the *Faculty*, to become a most powerful agent in the removal, at least in some degree, of nervous complaints.

The principle on which Sir Humphy proceeds is this: iron in contact with copper, prevents the copper being oxydated by the muriatic acid of sea-water, in consequence of the iron taking the oxygen of the acid to itself.

In a recent trial made on boats, it was found that the copper on their bottoms, which had protecting iron attached to it, became covered with animalculæ, which adhered so strongly to the copper, that they could not be removed, even by a broom. A ship's sailing must necessarily be retarded from such a state of her bottom. But the evil as quickly suggested the remedy, as the ingenuity of the inventor of PROTECTING IRONS prescribed, generally, in what the prevention to the oxydation of copper lay. And by proportioning the surface of iron to that of copper, in the ratio of one of the former to two hundred and fifty of the latter, it is now concluded, that the degree of galvanic energy will be such as will not seduce the animalculæ of the ocean from the paths of nature into those of galvanic intoxication.

It may be imagined, that these animals experience pleasurable sensations from the current of galvanic matter which circulates through, or pervades their frame; as, were the effect attended with painful feelings, their course would be in an opposite direction. Now, what I wish to see ascertained by experiment is, whether a similar galvanic circulation would not pervade a person immersed in a salt-water bath, having copper sides and protectors of iron (the metals being duly proportioned to each other), by his body forming part of the galvanic series, through which the galvanic current must necessarily circulate. As the body must part with, acquire, or suffer change of electric matter or nervous fluid, is there not reason for hoping that gout and rheumatism might yet be reduced, if not entirely removed, by such all-powerful, although invisible means?

A bath thus prepared, would, at all events, have its copper lining as well prevented from suffering oxidation, as a ship's bottom; and considering the novelty of the application, the rationale of the case, and the anticipated result, it is much to be desired that some of the faculty may become informed of the foregoing hints, and improve on them for the public benefit.

I shall conclude this paper by stating, that copper may be preserved free from oxidation by salt water, by japanning it, as it were, with pitch or tar. Let the copper be heated, the pitch or tar be rubbed over it with a brush, and the drying effected by evaporation, the sheet of copper being placed on a hot hearth, from the laying on of the stuff until it is dry. When properly done, the sheet will possess a coat of dry, hard, flexible matter, which is impervious to the effects of salt water, and even to those of muriatic acid. The idea originated from a former Number of this Magazine, wherein it is mentioned that copper of pumps in mines is preserved by tar.

The same materials will, individually, when applied in a similar manner, prevent the oxidation of *sheet iron* by salt water. Could iron be substituted for copper (the difference in pliability appears the principal obstacle), the saving would be immense; not less, perhaps, than 800*l.* on the bottom alone of a 74, even valuing the old sheathing, when stripped off, at no more than what bushel iron is worth.

In the use of either copper or iron, tar, which when laid on cold metal, keeps soft, and washes off in time, by being laid on heated metal, forms a fine strong japan, and so does pitch, similarly treated: it may be necessary to add a little tallow to the tar or pitch. Experience will dictate the necessary degree of temperature, and the shade that is best to terminate evaporation at; as at a little thicker than this, the covering becomes brittle, cracks, and flies off at the concave side of the metal, when bent. In cases where iron or copper is put into places subject to be occasionally damp, and perhaps in many other situations, the above manner of preserving it may not be unworthy of being known, in order to its being improved upon. Those employed in browning gun-barrels for the army, are likely to possess the best information on the subject.

Your obedient servant,

T. H. Pasley.

THREE-WHEELED CARRIAGES.

To the Editors of the Mechanic's Magazine.

Gentlemen; — Three-wheeled carriages seem to promise safety, without incurring the "to pay" of the Right Honourable the Chancellor of the Exchequer. What, then, hinders their being constructed?

The chief objections occurring to myself are,

1. That they would, especially in rough roads, come in contact with stones, inequalities, &c., at once impeding the course of a carriage, creating an unpleasant motion, and endangering the third wheel itself.

2. That it would be hard to prevent the third wheel from *thwarting* and *counteracting* the spring of a carriage.

But as the latter might be obviated by bringing from the perch two sloping iron stays, and through them "*axling*" the front wheel; so, probably, an ingenious head would find a remedy for the former. Old gentlemen, and family men, like myself, would feel our obligations to such a head neither few nor small, if it would arrange our three-wheels for us, and if it would add a plan for making shafts accommodate themselves to the place a horse assumes on falling, so as to prevent their snapping; he should, at all events, have every *fine day's* good wishes from

P. M.

ANSWERS TO INQUIRIES.

No. 22.—VARNISH FOR OIL PAINTINGS.

Liverpool, July 17, 1824.

The best method of making varnish for *oil paintings* that I know of is, to take of mastich, cleaned and washed, 6 ozs.; pure turpentine, ½ oz.; camphor, ¼ oz.; pure spirits of turpentine, 18 ozs. Add the camphor to the turpentine, which must be in a water-bath; when dissolved, add the mastich, and toward the end of the solution, add the turpentine. When all is dissolved, it may be filtered through cotton. This varnish recommends itself, as it may be easily cleaned from the painting with alcohol.

A good varnish for *painted wooden boxes* is made of seed lac, 3 ozs.; gum sandarac, 1 oz.; gum elemi, ½ oz.; Venice turpentine, ½ oz; and 15 ozs. of alcohol. Pound the lac sandarac and elemi together, put them into the alcohol, and set them in a warm place, shaking the bottle frequently till dissolved; then add the turpentine. If the boxes are required to be white, the following varnish, which also answers for fire-skreens, will do:—Take of gum sandarac, 3 ozs.; gum mastic, 2 ozs.; gum anime, 1 oz.; camphor, ½ oz.; spirit of wine, 18 ozs. Pound the dry and soft gums together; the camphor must be added in pieces; after the solution is nearly completed, add ½ oz of Venice turpentine. For varnishing boxes, ½ oz. of copal may be added; though the alcohol does not dissolve it all, it will make the varnish more durable.

P. S.—The second varnish is particularly adapted for varnishing Cumnock snuff-boxes, of the manufacture of which, at some future period, I will send you a sketch and description.

J. J.

No. 42.—REFINING GOLD.

Gentlemen;—I profess to have a thorough knowledge of refining coarse gold and silver, and am convinced that I was the first in the trade to put it into practice. Now, as we ought to live by our trade, I make this offer, that if my expences be defrayed, I will attend and teach the person wishing to put the method into practice, expecting to receive ten pounds as a gratuity. If volumes were written, it would be of no avail; the art must be taught practically. The expence of materials is trifling, and the method expeditious.

W. M.

A Working Goldsmith.

No. 15, Old-street-road,
Near the Curtain-road, London.

Another Answer.

In answer to the inquirer concerning the process of refining gold, I beg to say that, being a working goldsmith, and in the habit of performing it every week, I am fully capable of giving him all the information he desires; and if he feel disposed to give me what he offered to the Liverpool watch-case maker, and pay my coach-hire to his residence and back, I will superintend the process in person; to have my information on these conditions, he may write a letter directed N. M., No. 3, Penton-street, Walworth, Surrey.

A Journeyman Goldsmith.

Third Answer.

Gentlemen;—In answer to the inquiry of Niloc Esor, I beg leave to hand to you the following for insertion: Sulphur is used for purifying gold, as it unites with the metals with which it is alloyed; the gold must be first heated with crude antimony, in which state the sulphur is more fixed than when applied alone; during this process, the gold unites with a portion of antimony, which must be expelled by heat.

The following is extracted from Ure's Dictionary: — "Naphtha, ether, and essential oils take gold from its solvent, and from liquors which have been called portable gold. The gold, which is *precipitated* by evaporation of *these fluids*, or by the addition of *sulphate* of iron to the *solution* of gold, is of the *utmost* purity." To which I may add, from experience, that what Mr. Ure says is perfectly true.

Gentlemen, your constant reader,

Rose Colin.

INQUIRIES.

No. 47.—CEMENT.

Rectory House, Pickering, Yorkshire.

Gentlemen;—Permit me, through the medium of your valuable work, to ask your correspondents what is the best cement for uniting brass to glass; for instance, a brass cap at the end of a glass tube, wherein a thermometer is placed.

I am, Gentlemen, yours, &c.

Matt. Hayes.

[Our correspondent will find the other inquiry which accompanied this, answered by the article on Water-Proof Cloth in No. 47.—Edit.]

No. 48.—VIOLIN MAKING.

Sussex, June 8, 1824.

Gentlemen;—Having made a violin, a viola, and a violoncello for the amusement of myself and friends in our leisure hours, I have long since conceived the idea of making a violone, or double bass also; but being situated in a part of the country where an instrument of that sort is not to be found, I am totally at a loss to ascertain the proportion such an instrument bears to the violoncello.

Hoping that some one of the many of your liberal-minded readers will favour me (through your Magazine) with particulars sufficient to enable me to carry on my design, I am, Gentlemen,

With sincere respect,

"*But a Clown.*"

P. S.—*It* may not be irrelevant to state, that the particulars I want, are the length and width of instrument, width or depth of hoops, height of bridge, length and width of finger-board, length and thickness of neck and scroll, distance from nut to bridge, and extreme thickness of back and belly. It might be gratifying to many as well as myself, if some able hand were to furnish drawings of the different instruments I have named, with explanatory remarks, showing the relative dimensions and strength, or body of tone each bears to the other, in the concert of sounds that they produce, a knowledge of which would insure, generally, a more judicious use of them than is often found in the country.

No. 49.—FRICTION OF WHEELS.

It is a common practice to have the gudgeons of the wheels of many machines of iron, and to let them run in boxes of brass; I should take it as a favour, if any of your intelligent correspondents can inform me, whether the same quantity of *friction* would be overcome, if a machine were so constructed as for the *box to revolve*, and the gudgeon to be stationary? G.

No. 50.—OPTICS.

Rays of light falling in a parallel direction on a concave lens, after passing through the lens, diverge from the center. Now, it is required to know, if these diverging rays can be all collected, and again made parallel; and if so, by what combination of glasses can this be effected? B.

No. 51.—VENEERING.

The best methods for bending veneer, both long and cross-ways, in sharp circular work, and the best method for veneering pillars? W. E.

A Cabinet Maker.

No. 52.—STEEL COLOUR.

What are the various *colours* used in oil-painting to produce the different tints of steel? As I am anxious to procure this information, I shall not quarrel with the terms made use of: your correspondents may, notwithstanding Mr. Pasley's theory, venture to speak of the substances employed as if they really were possessed of colour. N. A.

MAGICAL CLOCK.

Droz, a Genevan mechanic, once constructed a clock which was capable of the following surprising movements:—There were seen on it a negro, a dog, and a shepherd. When the clock struck, the shepherd played six tunes on his flute, and the dog approached and fawned upon him. This clock was exhibited to the king of Spain, who was delighted with it. "The gentleness of my dog," said Droz, "is his least merit. If your majesty touch one of the apples which you see in the shepherd's basket, you will admire the fidelity of this animal." The king took an apple, and the dog flew at his hand, and barked so loud, that the king's dog, which was in the room, began also to bark. At this the courtiers, not doubting that it was an affair of witchcraft, hastily left the room, crossing themselves as they went out: the minister of marine was the only one that ventured to stay. The king having desired him to ask the negro what o'clock it was, the minister obeyed, but he obtained no reply. Droz then observed, that the negro had not yet learned Spanish, upon which the minister repeated the question in French, and the black immediately answered him. At this new prodigy the firmness of the minister also forsook him, and he retreated precipitately, declaring that it must be the work of the devil.—*Griscom's Year in Europe.*

NEW PATENTS.

To William Ainsworth Jurnp, of Middlewich, Cheshire, salt proprietor, and William Court, of Manor Hall, Cheshire, esquire, for their improved method of manufacturing salt.—15th June—2 months.

To Richard Hooton, of the Aqueduct Iron-Works, Birmingham, Warwickshire, iron manufacturer, for certain improvements in manufacturing wrought iron.—15th June—6 months.

To William Harwood Horrocks, of Stockport, Cheshire, cotton manufacturer, for his new apparatus in giving tension to the warp in looms.—15th June—6 months.

To Robert Garbutt, of the town of Kingston-upon-Hull, merchant, for his apparatus for the more convenient filing of papers and other articles, and protecting the same from dust or damage, including improvements on or additions to the files in common use.—15th June—6 months.

TO CORRESPONDENTS.

Mr. Stacy, we dare say, will not be displeased that we have given the preference to B. T.'s communication. If there are any parts of his letter not anticipated by B. T. which he would still wish to have inserted, they shall have a place in our next.

Mr. Blake, on the same subject, agrees throughout with B. T. and Mr. S.

We are obliged to N.—Juvenis—and Mentor, for the support of their opinions.

Diable Boiteux—Not possible! The Committee cannot be expected to like what we have said, but they have more sense and liberality surely, than to entertain such a motion as that alluded to.

Communications received from W. D. —J. H. Snell—H. D.—John Barton—P. P—Lover of Improvements—Scriba—G. A. S.—James Jackson—Bib—Samuel Ellington—J. Maule—Unit—A Youth—J. W. A.—Egroeg—Samuel P. Hinde—A. B.—Investigator—Marley—F.—and Enquirer.

ERRATUM.

Page 306, Vol. II. 1st line, 1st column, for *Wandsworth* read HANDSWORTH.

Communications (post paid) to be addressed to the Editors, at

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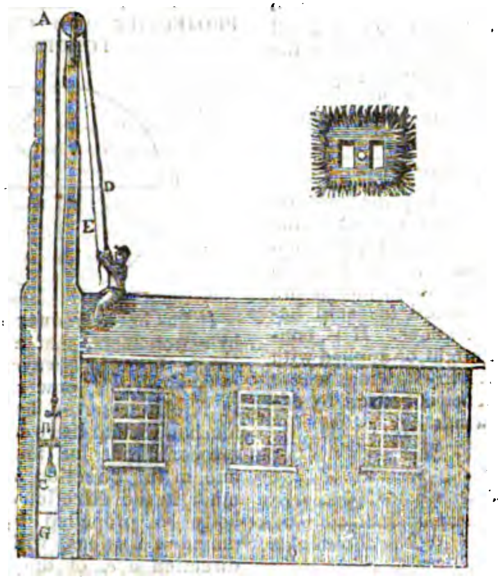
Mechanic's Magazine,

Museum, Register, Journal, & Gazette.

Know the Great Genius of this land
Has many a light and aerial band,
Who all beneath his high command
Harmoniously,
As arts or arms they understand,
Their labours ply.—*Burns.*

No. 50.] SATURDAY, AUGUST 7, 1824. [Price 3d.



MODE OF SWEEPING ENGINE CHIMNEYS.

GENTLEMEN;—I have frequently been subjected to great inconvenience, in not being able to get my engine-chimney swept when required, and was led to devise a mode that would obviate this evil. I have found it extremely useful, having by means of it swept the chimneys of my manufactory a great many times in the best manner. It has this advantage, that it may be done while the chimney is too hot for the ascent of a man or boy, and it is also attended with a great saving of time and trouble.

G. W. T.

Description of the Engraving.

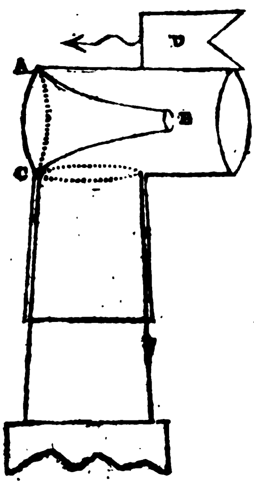
A is the sheave or pulley-wheel, over which runs a cord E, held at one end by the workman; to the other end is fixed a brush B, made to the size and shape of the chimney, just tight enough to clear off the soot; C, a small weight to sink the brush when working it up and down; D, a series of rods of sufficient length to reach the top of the chimney from any convenient situation, inserted together similar to a bayonet on a musket. The cord with a weight is first let down the chimney; then the brush is put on at the opening G, and drawn up and down, as may be required. There is also a hook attached to the rod to fix on the chimney. Should the chimney have a pot on the top, an additional brush is united to the other, by means of a short wooden rod, at a sufficient distance above B.

The brushes I make use of are made of birch twigs, from a broom about 5 inches long, and screwed between two frames, as represented in the prefixed drawing.

I have never had but these two made, and they are now as good as at first, although used when the chimney has been so very hot that it would have been utterly impossible for a man or boy to have gone up it.

SMOKY CHIMNEYS.

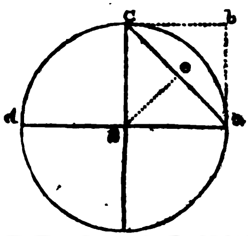
The following improvement on the common traversing cowl on the top of chimneys, was copied from a French frigate, by Captain Warren, Royal Navy, and found to answer on board his ship beyond his expectations. It is conceived that it might be applied with effect on shore, in situations where the inconvenience is caused by eddies or high winds.



The contrivance is simply inserting into the back of the common cowl a tube A B C, shaped like a speaking-trumpet, and open at both ends. A vane, D, may be added to assist its traversing, and to ensure the mouth, A C, being constantly presented to the wind, by which a strong draft over the mouth of the cowl and beyond the top of the chimney is created.

On board of ship the cowl is turned round by hand to its proper direction, on account of the motion of the vessel.

PROJECTILE AND GRAVITATING FORCES.



It has been frequently asserted by astronomers, that a *double* projectile force is always equivalent to a *quadruple* power of gravity. It is also asserted by writers on mechanics, that if two equal motions are communicated to a body at *a*, one in the direction *a b*, and the other in the direction *a s*, that the body so propelled by the compounded motions, will pass in the direction *a c*, or diagonal of the square *a b c s*. Now, suppose the earth to be situated at *a*, and the projectile and gravitating forces, communicated at the commencement of its motion, to be equal; the projectile force will be in the direction *a b*, and the gravitating force in the direction *a s*; the earth will consequently pass from the effects of the compounded motions in the direction of the diagonal, *a c* (the sun being supposed at an infinite distance).

But suppose the sun to be situated at *s*; the earth in passing in the direction *a c*, arrives at *e*, in which case it is nearer the sun than it was at *a*, in proportion as the side of a square is to its diagonal.

Now, if we admit that the sun's attractive power is inversely as the square of its distance, its attraction on the earth will be accelerated before the earth arrives at *e*, and consequently the earth drawn nearer the sun, as the earth will evidently be advancing towards the sun from the first moment that the projectile and gravitating forces were communicated, and after performing a few revolutions in a spiral curve, will fall on the body of the sun.

It is evident, from the above demonstration, that the *gravitating* force can never be equal to the *projectile*; otherwise, the body cannot revolve in a circular orbit, but will pass in a spiral path, till it falls on the sun, as it is very clear that the *projectile* force of the body must be increased, in order that it may revolve in the circular orbit *a c d*; consequently this law appears to be quite the reverse of that given by astronomers.

As there are many persons besides myself, who perhaps cannot reconcile the subjects in question, the correspondents of the Mechanic's Magazine are respectfully solicited to consider the above theories. MAJERTINGUN.

[This problem has been cleverly discussed in an essay recently published by Captain Forman, R. N. "On the Laws of Gravity," &c. &c. "With equal propriety," he says, "it might be asserted, that though one quart of water will only balance two pints, two quarts will balance eight pints." To show this more clearly, he supposes the case of a man swimming across a stream; the direction in which he moves is of course in a diagonal line between the direction of the two forces; suppose, then, the strength of the stream to be suddenly increased *fourfold*, would it not be necessary for the man to swim with *four* times his former velocity—that is, to exert a *quadruple* projectile force, in order to proceed in the same direction? And if so, how can it be said that a double projectile force will balance a fourfold power of gravity? Captain F. thinks that there is nothing in the Cartesian, or even in the Aristotelian philosophy, half so extravagant as this; and that if men can believe it merely because it has been advanced by some philosopher of eminence, they would with equal facility have believed the earth to be an extended plain, if it had been so set down in their books; for both the one and the other notion betray an equal absence of thinking.—*Edit.*]

On the Corrosion of Copper Sheeting, &c. By Sir HUMPHRY DAVY. *(From the Philosophical Transactions for 1824. Part I, just published.)*

1. The rapid decay of the copper sheeting of his majesty's ships of war, and the uncertainty of the time of its duration, have long attracted the attention of those persons most concerned in the naval interests of the country. Having had my inquiries directed to this important object by the commissioners of the Navy-Board, and a committee of the Royal Society having been appointed to consider of it, I entered into an experimental investigation of the causes of the action of sea-water upon copper. In pursuing this investigation, I have ascertained many facts which I think not unworthy of the Royal Society, as they promise to illustrate some obscure parts of electro-chemical science; and likewise seem to offer important practical applications.

2. It has been generally supposed that sea-water had little or no action on pure copper, and that the rapid decay of the copper on certain ships was owing to its impurity. On trying, however, the action of sea-water upon two specimens of copper, sent by John Vivian, esq. to Mr. Faraday for analysis, I found the specimen which appeared absolutely pure, was acted upon even more rapidly than the specimen which contained alloy: and, on pursuing the inquiry with specimens of various kinds of copper which had been collected by the Navy Board, and sent to the Royal Society, and some of which had been considered as remarkable for their durability, and others for their rapid decay, I found that they offered very inconsiderable differences only in their action upon sea-water; and, consequently, the changes they had undergone must have depended upon other

causes than the absolute quality of the metal.

3. To enable persons to understand fully the train of these researches, it will be necessary for me to describe the nature of the chemical changes taking place in the constituents of sea water by the agency of copper.

When a piece of polished copper is suffered to remain in sea-water, the first effects observed are, a yellow tarnish upon the copper, and a cloudiness in the water, which take place in two or three hours: the hue of the cloudiness is at first white; it gradually becomes green. In less than a day a blueish-green precipitate appears in the bottom of the vessel, which constantly accumulates; at the same time that the surface of the copper corrodes, appearing red in the water, and grass-green where it is in contact with air. Gradually carbonate of soda forms upon this grass-green matter; and these changes continue till the water becomes much less saline.

The green precipitate, when examined by the action of solution of ammonia and other tests, appears principally to consist of an insoluble compound of copper (which may be considered as a hydrated sub-muriate) and hydrate of magnesia.

According to the views which I developed fourteen years ago, of the nature of the compounds of chlorine, and which are now generally adopted, it is evident that soda and magnesia cannot appear in sea-water by the action of a metal, unless in consequence of an absorption or transfer of oxygen. It was therefore necessary for these changes, either that water should be decomposed, or oxygen absorbed from the atmosphere. I found that no hydrogen was disengaged, and consequently no water decomposed: necessarily, the oxygen of the air must have been the agent concerned, which was made evident by many experiments.

Copper in sea-water deprived of air by boiling or exhaustion, and exposed in an exhausted receiver or an atmosphere of hydrogen gas, underwent no change; and an absorption in atmospherical air was shown when copper and sea-water were exposed to its agency in close vessels.

4. In the Bakerian Lecture for 1806, I have advanced the hypothesis, that chemical and electrical changes may be identical, or dependent upon the same property of matter; and I have further explained and illustrated this hypothesis in an elementary work on Chemistry, published in 1812. Upon this view, which has been adopted by M. Berzelius and some other philosophers, I have shown that chemical attractions may be exalted, modified, or destroyed, by changes in the electrical states of bodies; that substances will only combine when they are in different electrical states; and that, by bringing a body naturally positive artificially into a negative state, its usual powers of combination are altogether destroyed; and it was by an application of this principle that in 1807 I separated the bases of the alkalies from the oxygen with which they are combined, and preserved them for examination; and decomposed other bodies formerly supposed to be simple.

It was in reasoning upon this general hypothesis likewise, that I was led to the discovery which is the subject of this paper.

Copper is a metal only weakly positive in the eltro-chemical scale; and, according to my ideas, it could only act upon sea-water when in a positive state; and, consequently, if it could be rendered slightly negative, the corroding action of sea-water upon it would be null; and whatever might be the differences of the kinds of copper sheeting and their electrical action upon each other, still every effect of chemical action must be prevented, if the whole surface were rendered negative. But how was this to be effected? I at first thought of using a Voltaic battery; but this could be hardly applicable in practice. I next thought of the contact of zinc, tin, or iron, but I was for some time prevented from trying this, by the recollection that the copper in the Voltaic battery, as well as the zinc, is dissolved by the action of diluted nitric acid; and by the fear that too large a mass of oxidable metal would be required to produce decisive results. After reflecting, however, for some time on the slow and weak action of sea-water on copper, and the small difference which must exist between their electrical powers; and knowing that a very feeble chemical action would be destroyed by a very feeble electrical force, I resolved to try some experiments on the subject. I began with an extreme case. I rendered sea water slightly acidulous by sulphuric acid, and plunged into it a polished piece of copper, to which a piece of tin was soldered equal to about one-twentieth of the surface of the copper. Examined after three days, the copper remained perfectly clean, whilst the tin was rapidly corroded: no blueness appeared in this liquor; though, in a comparative experiment, when copper alone and the same acid mixture was used, there was a considerable corrosion of the copper, and a distinct blue tint in the liquid.

If one-twentieth part of the surface of tin prevented the action of sea-water, rendered slightly acidulous by sulphuric acid, I had no doubt that a much smaller quantity would render the action of sea-water, which depended only upon the loosely attached oxygen of common air, perfectly null; and on trying $\frac{1}{200}$ part of tin, I found *the effect* of its preventing the corrosion of the copper perfectly decisive.

5. This general result being obtained, I immediately instituted a number of experiments, in most of which I was assisted by Mr. Farraday, to ascertain all the circumstances connected with the preservation of copper by a more oxidable metal. I found, that whether the tin was placed either in the middle, or at the top, or at the bottom of the sheet of copper, its effects were the same; but, after a week or ten days, it was found that the defensive action of the tin was injured, a coating of sub-muriate having formed, which preserved the tin from the action of the liquid.

With zinc or iron, whether malleable or cast, no such diminution of effect was produced. The zinc occasioned only a white loud in the sea-water, which speedily sunk to the bottom of the vessel in which the experiment was made. The iron occasioned a deep orange precipitate: but after many weeks, not the smallest portion of copper was found in the water; and so far from its surface being corroded, in many parts there was a regeneration of zinc or of iron found upon it.

6. In pursuing these researches, and applying them to every possible form and connection of sheet copper, the results were of the most satisfactory kind. A piece of zinc as large as a pea, or the point of a small iron nail, were found fully adequate to preserve forty or fifty square inches of copper; and this, wherever it was placed, whether at the top, bottom, or in the middle of the sheet of copper, and whether the copper was straight or bent, or made into coils. And where the connection between different pieces of copper was completed by wires, or thin filaments of the fortieth or fiftieth of an inch in diameter, the effect was the same; every side, every surface, every particle of the copper remained bright, whilst the iron or the zinc was slowly corroded.

A piece of thick sheet copper, containing on both sides about sixty square inches, was cut in such a manner as to form seven divisions, connected only by the smallest filaments that could be left, and a mass of zinc, of the fifth of an inch in diameter, was soldered to the upper division. The whole was plunged under sea water; the copper remained perfectly polished. The same experiment was made with iron; and now, after a lapse of a month, in both instances, the copper is as bright as when it was first introduced, whilst similar pieces of copper, undefended, in the same sea-water, have undergone considerable corrosion, and produced a large quantity of green deposit in the bottom of the vessel.

A piece of iron nail, about an inch long, was fastened by a piece of copper wire, nearly a foot long, to a mass of sheet copper, containing about forty square inches, and the whole plunged below the surface of sea water; it was found, after a week, that the copper was defended by the iron in the same manner as if it had been in immediate contact.

A piece of copper and a piece of zinc soldered together at one of their extremities, were made to form an arc in two different vessels of sea water; and the two portions of water were connected together by a small mass of tow, moistened in the same water: the effect of the preservation of the copper took place in the same manner as if they had been in the same vessel.

As the ocean may be considered, in its relation to the quantity of copper in a ship, as an infinitely extended conductor, I endeavoured to ascertain whether this circumstance would influence the results; by placing two very fine copper wires, one undefended, the other defended by a particle of zinc, in a very large vessel of sea-water, which water might be considered to bear the same relation to so minute a portion of metal as the sea to the metallic sheeting of a ship. The result of this experiment was the same as that of all the others; the defended copper underwent no change; the undefended tarnished, and deposited a green powder.

Small pieces of zinc were soldered to different parts of a large plate of copper, and the whole plunged in sea-water: it was found that the copper was preserved in the same manner as if a single piece had been used.

A small piece of zinc was fastened to the top of a plate of polished copper, and a piece of iron of a much larger size was soldered to the bottom, and the combination placed in sea-water. Not only was the copper preserved on both sides in the same manner as in the other experiments, but even the iron; and after a fortnight, both the polish of the copper and the iron remained unimpaired.

7. I am continuing these researches, and I shall communicate such of them as are connected with new facts, to the Royal Society.

The Lords Commissioners of the Admiralty, with their usual zeal for promoting the interests of the Navy by the application of science, have given me permission to ascertain the practical value of these results by experiments upon ships of war; and there seems every reason to expect (unless causes should interfere of which our present knowledge gives no indications) that small quantities of zinc, or, which is much cheaper, of malleable or cast-iron, placed in contact with the copper sheeting of ships, which is all in electrical connection, will entirely prevent its corrosion. And as negative electricity cannot be supposed favourable to animal or vegetable life; and as it occasions the deposition of magnesia, a substance exceedingly noxious to land vegetables, upon the copper surface; and as it must assist in preserving its polish, there is considerable ground for hoping that the same application will keep the bottoms of ships clean—a circumstance of great importance both in trade and naval war.

It will be unnecessary for me to dwell upon the economical results of this discovery, should it be successful in actual practice, or to point out its uses in this great maritime and commercial country.

I might describe other applications of the principles to the preservation of iron, steel, tin, brass, and various useful metals; but I shall reserve this part of the subject for another communication to the Royal Society.

Reply to an erroneous Statement respecting Sir Humphry Davy's Method of Defending the Copper Sheeting for Ships' Bottoms. By J. G. Children, F. R. S., &c. *one of the Editors of the Annals of Philosophy.*

Since Sir Humphry Davy's paper was printed, the 82nd Number of a weekly publication, called the Mechanic's Magazine, has been put into my hands, which contains an article, signed Samuel Deacon, and entitled "Sir Humphry Davy's Remedy for the Decay of Copper Bottoms, not original." The assertion is founded on the following advertisement in "The World" newspaper, of April 16, 1791:—"By the King's patent, *tinned copper* sheets and pipes, manufactured and sold by Charles Wyatt, Birmingham, and at 19, Abchurch-lane, London." These sheets, amongst other advantages, "are particularly recommended *for sheathing of ships*, as possessing all the good properties of copper, with others obviously superior, which the following extract from a report founded on actual experiment, by Dr. Higgins, clearly demonstrates, viz. that this coating of tin powerfully resists the action of salt water, and, by preventing the corrosion of the copper, operates as a preservative of the iron placed contiguous to it."

The best answer to this attack we have given already, by laying Sir Humphry Davy's paper, from the Philosophical Transactions, before our readers, from which it is most obvious, that his views have nothing in common, except their object, with those of the patentee aforesaid. As far as the extract given by his advocate, Mr. Deacon, enables us to judge, it seems that the superiority claimed by Mr. Wyatt consists merely in coating the surface of the copper sheets with some substance less subject to corrosion by sea water than that metal, and his idea was probably borrowed from the common practice of tinning culinary copper vessels;—a practice known to and adopted by the Romans.* As Mr. Deacon gives no particulars of the mode of applying or preparing these tinned plates, it is fair to infer that there was nothing peculiar to them in either respect, and all the claim that he can possibly make out to originality is in the application of an old fact to a new purpose.

But it is not on the substitution of tinned copper for plain copper, that Sir Humphry Davy's pretensions to originality rest: it is in the *principle* on which that substitution, or rather an equivalent, and, as we shall presently see, a superior process is recommended, that his claims are founded. For the explanation of that principle, I refer the reader to Sir Humphry Davy's paper; but I will ask, did Mr. Wyatt know, that even though nine-tenths of the tin be

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* Stannum illitum æneis vasis saporem gratiorem facit, et compescit æruginis virus, &c.—*Plin. Hist. Nat.* lib. 34, c. 17.

worn away from a copper saucepan, and the copper exposed, the vessel may still be used with safety? Could he have explained the cause, if he knew the fact? When he prepared his sheets, did he carefully tin the whole surface, or was he aware that if the preservative metal were applied to a comparative speck of it only, it would be equally effectual? Or, lastly, had he the remotest idea that, so applied, it would act as a preservative at all? If he did know all this, he knew much more than one of the ablest chemists of the day; for Dr. Watson, in the seventh edition of his essays, published in 1800, insists very strongly on the danger of tinned copper vessels *in case of abrasion of the tin; and so apprehensive was he of the consequences of the minutest portion of copper being uncovered*, that he says that "a new copper vessel, or a copper vessel newly tinned, is more dangerous than after it has been used; because its pores, which the eye cannot distinguish, get filled up with the substances which are boiled in it, and all the sharp edges of the prominent parts become blunted, and are thereby rendered less liable to be abraded." Dr. Watson, therefore, was so far from being aware of the principle on which Sir Humphry Davy's invention is founded, that he obviously was not even aware of the fact alluded to; and the Birmingham patentee was probably not much better informed than the bishop of Llandaff. At the date of Mr. Wyatt's patent, and for many years after, all the world was ignorant of the principle of action of the defending metal; nor was it developed till the instrument of Volta, in the hands of Davy, furnished the clue; and its present important application is, in fact, an extension of the same train of reasoning that led to his preceding discoveries in electro chemical science.

"It is in the *principle*, therefore, I repeat, that the merit and originality of Sir H. Davy's method is founded, and the importance of the principle is confirmed by a circumstance which would have rendered a mere mechanical covering, like Mr. Wyatt's, useless and abortive. The defended copper is more liable to become foul from the adhesion of barnacles, weeds, &c. than the undefended. Had Mr. Wyatt's tinned sheeting been adopted, it would have been subject to the same pest, nor is it probable that in the then state of chemical science, he could have suggested a remedy for the evil. With the light thrown on the subject by Davy, the antidote is obvious. Barnacles, &c. do not adhere to the undefended copper, because the oxide on its surface poisons them; but the clean metallic surface of the defended copper does them no harm. All that is necessary, therefore, is to weaken the defensive action, by diminishing the extent of the defending surface to such a point as to allow a slight oxidation of the copper, sufficient to repel the animalculæ, but not sufficient to occasion a serious waste of the metal.

COCO-NUT TREE WOOD.

GENTLEMEN;—I beg to hand you a specimen of the wood of the coco-tree. If it appears to you that this wood might be made useful in the Arts, perhaps you will have the goodness to bring it to the notice of the public by mentioning its qualities in your very excellent and useful publication.

A CONSTANT READER.

The best account that we have met with (and it is a very able one, displaying great research and ability) of the coco-nut tree alluded to by our correspondent, is to be found in a paper in the Memoirs of the Wernerian Natural History Society, contributed by Mr. HENRY MARSHALL, *Surgeon to the Forces, and Author of Notes on the Medical Topography and Diseases of the Interior of Ceylon*. We extract the following interesting particulars from that account:—

The coco-nut tree, both in regard to the variety and utility of its products, is the most interesting of the palm tribe, "the princes of the vegetable kingdom." It has its *habitat* in intertropical Asia, Australia, America, and Africa. It is by some authors said to have, in ancient times, been cultivated in Arabia; but NIEBUHR informs us, that it is not found to the north of Mocha. Like all other equinoctial plants, the coco-nut tree becomes less luxuriant as we approach the Tropics. At the suggestion of Mr. DUNLOP, who lately, in so able a manner, superintended the work now in progress, to clear Saugur Island, at the estuary of the Hooghly, that den of tigers is likely soon to be a continued grove of coco trees. Saugur lies in N. Lat. 21° 30′, which is, perhaps, as far from the Equinoctial Line as this species of palm can be cultivated with advantage. It appears to occupy a zone of 25°

of latitude on both sides of the Equator, which includes nearly four-fifths of Africa, one-sixth of Asia, one-third of America, and excludes Europe."

The coco is of an erect stem, from 60 to 90 feet in height, and from 1 to 2 feet in thickness. The stem is crowned with a bunch of 12 or 15 fronds (palm leaves), each 12 or 14 feet long. A single leaf closely resembles a greatly magnified ostrich feather. The wood of the stem is composed of hard, flexible, ligneous, black fibres, united by a soft brownish pith, or cellular substance.

Towards the base of the trunk the wood is remarkably hard, and admits of a high polish. A transverse section of this part of the tree, when well polished and varnished, has a lapideous gloss and beauty, which rival those of an agate. Mr. Marshall has seen a polished portion of the wood set in the lid of a silver snuff-box, in the same manner as jewellers occasionally fix agates or cornelians. It might, he thinks, be found highly useful in ornamental cabinet-work.*

In some parts of the world, a kind of cradle or couch for young infants is made of the reticulated substance formed at the base of the leaf. The unexpanded leaves or terminal leaf bud is occasionally eaten by the Europeans as well as by natives. When boiled, it is tender, and forms a good substitute for cabbage. The natives sometimes preserve it in vinegar, and eat it as a pickle. It may be observed, that the tree dies when this part is removed. Many of the indigenous inhabitants, as well as natives of Europe, thatch their houses with coco-nut leaves, in the Singhalese language called *polatta*. Sometimes they are denominated *ollahs*, and at other times *cadjans*. To prepare *cadjans*, the central ligneous portion of the leaf is divided longitudinally; the leaflets of each half are then plaited or interwoven, by which means they are adapted for a variety of uses. In this state they are employed to thatch cottages, to shelter young plants from the scorching rays of the sun, to construct fences, to form the ceiling of rooms, and to make baskets for carrying fruit, fish, &c. Sometimes baskets are made of palm-leaves, so close as to serve the purpose of buckets to draw water from deep wells.

The immature leaves of the coco-nut tree have a fine yellow colour, and a beautiful texture resembling fine leather or satin. In some parts of Ceylon, the natives evince great taste in ornamenting triumphal arches, as also ball-rooms, and similar places of public resort, with the leaves of this tree, and some remarkably beautiful species of moss. As the young leaves are translucent, they serve to make lanterns, in the construction of which many of the inhabitants are very dexterous.

In the island of Otaheite, the female inhabitants wear bonnets constructed of the leaflets of the coco; and in Ceylon the European soldiers manufacture hats of small strips of the leaves, in the same manner that straw-hats are made. Indeed, broad-brimmed hats of this construction are frequently worn both by Europeans and natives, particularly by fishermen, who are much exposed to the direct rays of an ardent sun.

The leaflets are sometimes used to write upon, and the instrument employed to make the impression is an iron stylus. The leaves of the Palmyra (*Borassus flabelliformis*), or Talipot (*Corypha umbraculifera*), are, however, much more frequently employed for this purpose. Contracts and other legal instruments are often engraven upon tablets of copper, which have occasionally a border of silver. An allusion is made to the practice of writing upon tablets in Isaiah xxx. 8, and Habakkuk ii. 2. Palm-leaves generally undergo some preparation to fit them to receive the impression of the stylus. They are then called *ollahs*. The natives write letters to one another upon *ollahs*, which are neatly rolled up, and sometimes sealed with a little gum-lac. During the operation of writing, the leaf is supported by the left-hand, and the letters scratched upon the surface with the pointed piece of iron. Instead of moving the hand with which they write towards the right, they move the leaf in a contrary direction, by means of the thumb of the left-hand. To render the characters more legible, the engraved lines are frequently filled by besmearing the leaf with fresh cow-dung. This substance is then tinged black, which makes the writing very plain. Sometimes this object is obtained by rubbing the lines over with coco-nut oil, or a mixture of oil and charcoal-powder. The natives do not require tables to write upon; they can write standing as well as walking.

Baskets for catching fish, shrimps, &c. are made of the ligneous ribs of the

* It has been so employed by some cabinet-makers in town, and much admired. It has a beautiful mottled appearance, something like a tortoise shell, only more minutely spotted.—*Edit.*

leaflet; the same substance is employed by the natives for many of the purposes for which we use pins. A bundle of these ribs is in universal use, as a broom, to sweep the cottages; and when a European asks for a tooth-pick, his servant brings him a portion of one of these fibres.

In a domestic state elephants are fed chiefly upon coco-nut leaves, and this animal evinces much sagacity in separating the elastic woody fibre from the thinner margin of the leaf.

For temporary purposes, cadjan-houses are frequently constructed, both by natives and Europeans. During the insurrection in the Kandyan country in 1818, many of the sick were accommodated in cadjan hospitals. Except the frame-work, every part of the house, walls, and roof, is formed of coco-nut leaves. They are capable of resisting all kinds of weather for a year or more.

In warm climates it is customary to travel during night, with the view of avoiding the influence of an ardent sun. Torches then become necessary, and coco-nut leaves are chiefly employed for this purpose. When burned, the coco-nut tree, especially the leaves, afford a large proportion of pot-ash. The caste of washermen avail themselves of this quality, and procure all the pot-ash they require by the incineration of different parts of the tree. Soap is very little used by the native washermen in Ceylon.

Boats are rowed with the centre-rib of the leaf, in which operation it forms a substitute for paddles. The end of this part of the leaf is sometimes well-bruised, and thereby converted into a brush, that may be used for a variety of purposes.

The spaths, or fibrous covering of the blossoms, are inflammable; on that account they are often employed as torches. In some parts of India this part of the tree is soaked in water, and converted into coarse cordage, with which the thatch of houses is tied.

Many useful products are derived from the flower and fruit of this tree. By a peculiar manipulation the flower yields a rich saccharine juice, convertible into arrack or sugar.

Sweet juice is extracted from the unexpanded flower. A good healthy blossom will give from two to four English pints of sweet juice daily, and some flowers will continue to yield juice for about four or five weeks. Hence there are frequently two spaths on one tree, yielding toddy at the same time.

Ceylon exports annually, and, for the most part, to the Presidencies of Bengal, Madras, and Bombay, from 5,000 to 6,000 leaguers of arrack, each containing 150 gallons. Including freight, duties, upon exportation and importation, this spirit is sold at Madras at about 1*s.* 3*d.* per gallon. The prime cost of arrack in Ceylon varies from 8*d.* to 10*d.* per gallon. It is stated by Mr. BARTOLACCI, that arrack distilled at Batavia, is said to be sold in India from 10 to 15 per cent cheaper than that brought from Colombo.* Ten per cent duty is levied upon arrack exported from Ceylon. In England, this spirit has brought as high a price as from 5 to 6 shillings per gallon.

Batavian arrack is made from a mixture of molasses, palm-wine, and rice, in the following proportions:

Molasses	62 parts.
Toddy (palm-wine)	3 ditto.
Rice	35 ditto.

100 parts of these materials yield 23½ of distilled proof arrack.

When intimately mixed with lime, the sugar manufactured from palm juice, or jagery as it is called, forms an excellent cement, which resists moisture, and endures great solar heat. It is capable of taking on a very fine polish. Walls are prepared for receiving this covering, by wetting them with a strong infusion of the husk of unripe cocos; and the same kind of fluid is used for mixing and tempering the materials. In Madras, and some other parts of India, the flat tops of the houses are covered with this cement. It is much employed to cover columns, as also to form the floors of rooms. Floors of this kind are sometimes stained and made to resemble the finest marble. It is said that jagery-cement has succeeded very well in Holland. In 1813, Ceylon exported jagery to the value of 39,245 rix dollars. The Ceylon rix dollar at par, is equal to 1*s.* 9*d.* sterling.

When the flower has not been injured, the tree bears nuts which are converted to many useful purposes. Young coco-nuts are much used by the natives as an article of diet. The native inhabitants of the coasts of some of the islands in the Equinoctial Zone, are more palmivorous than granivorous. Where a people can be satisfied with food so easily procured as the produce of the coco-nut tree is, in some tropical regions, they are little sensible to the ordinary motives which impel mankind to labour. The Reverend Mr. CORDINER says, and per-

* Bartolacci on the "Revenue and Commerce of Ceylon."

haps with truth, that the person who possesses a garden with twelve coco trees and two jack trees, has no call to make any exertion.

Sago is also easily obtained from the interior part of the trunk of these trees. The process consists in pounding the spongy or cellular texture of the stem, and washing it with water, which is strained, to separate the ligneous fibres from the feculent substance.

The husk or fibrous pericarp of the nut is employed to polish furniture, and to scour the floors of rooms, &c. Birds, who build pendulous nests, commonly construct them of this substance. Its chief use, however, is in the manufacture of *coir*, and for this purpose the nut ought not to be completely ripe. The word *coir*, sometimes written *cair*, and *caira*, is probably derived from the Portuguese substantive *cairel*, a periwig, or fringe. The Singhalese word for *coir* is *kohu*. To remove the husk, an iron-spike, or sharp piece of hard wood, is fixed in the ground; the nut is then forced upon the point, which passes through the fibres, thereby separating the rind from the shell. In this manner a man can clear 1,000 nuts daily. *Coir* is prepared by soaking the rind in water for several months, and then beating it upon a stone with a piece of heavy wood. On the coast of America, where a running stream of water is not near at hand, the coir-manufacturers dig holes in the sand below high water-mark, and bury the rind of the coco-nut, before beating it. Subsequently it is rubbed with the hand until the interstitial substance be completely separated from the fibrous portion of the husk. The rind of forty cocos furnished Mr. KOSTER with six pounds weight of coir. The next operation is to twist the fibres into yarns, which are manufactured into cordage of all sizes. Coir is remarkably buoyant, and well suited for ropes of a large diameter. Until chain-cables were introduced, all the ships which navigated the Indian seas had cables made of this substance. Sea-water is said to be rather beneficial than hurtful to it. Coir-cordage, when properly prepared, is pliable, smooth, strong, and elastic: it is very well suited for running-rigging, more especially where lightness is deemed an advantage, such as top-gallant studding-sail sheets, &c. On account of its contractility, seamen consider it not well fitted for standing rigging. Dr. ROXBURGH, in his observations on the comparative strength of English hemp and other vegetable fibres, states, that he found hemp-rope and coir-rope, when large, to be respectively as 108 to 87 in strength, and when smaller as 65 is to 40. In the same paper (Transactions of the Society of Arts, vol. ii.), he says, "Coir is certainly the very best material yet known for cables, on account of its great elasticity and strength."

The natives sew the planks together which compose their boats with coir-yarns. When twisted into yarns adapted for being manufactured into cordage, it is valued in Ceylon at about 2*l*. per candy (500 lb.) Large quantities of this substance are exported to the different ports in India. Under the Dutch government about 3,000,000 lb. were annually manufactured in the island. The quantity of coir exported from Ceylon in 1813, amounted to 4,048½ candies, and each candy may be valued at 28 rix dollars, total amount rix dollars 137,649. Very lately a manufactory for the making of coir-cordage has been established upon a large scale at Recif, near to Pernambuco, on the coast of Brazil.

Coir is much used in India in place of hair to stuff mattresses, cushions for couches, saddles, &c. It is also employed to make brooms and brushes to white-wash houses.

The kernel of the ripe coco-nut is not unlike the substance of an almond either in taste or consistence. It is eaten by the natives, and frequently along with jagery. The natives of the Ladrone Islands eat it in lieu of bread, with meat and fish. Sometimes it is rasped into very small pieces, and mixed with dressed rice, to give it a peculiar flavour; and occasionally it is pounded into meal, of which fritters and small cakes are made. In India this fruit is generally allowed to be very nutricious, and many suppose that it possesses the quality of inducing corpulence.

By a little pressure the kernel may be made to yield a white fluid resembling milk. When the milk of cows or buffaloes cannot be procured, Europeans sometimes add this liquid to tea as a substitute. Another substitute for milk may be obtained by rasping a kernel, and mixing the scrapings with some of the liquid contained in a nut: this mixture requires to be strained. We are informed by Dr. PINCKARD, in his Notes on the West Indies, that puddings are made of coco-nuts in Barbadoes. The kernel is sometimes pressed with honey and sugar, and used to make preserves.

When mature, the nut is much used

in Ceylon, to furnish an oleaginous fluid required to prepare *curry*, a dish in very general use among all ranks and classes in India.

"But the chief product of the kernel of the coco-nut is an excellent oil. On an average ten nuts are stated by Mr. Bartolacci to yield about a quart of oil; but Koster, who made the experiment, says, that thirty-two nuts rendered him only three pound of pure oil."

The watery part of the kernel is dissipated by exposing it to the sun for a few days, during which period it acquires a considerable degree of rancidity. In this state the kernel is called *copra*, or *copperas*. The oil is extracted from copra by grinding it in a very clumsy mill, which is worked by bullocks. Oil has for some years past been extracted from copra in large quantities at Colombo, by means of the power of a steam-engine. The value of copperas exported from Ceylon, in 1813, amounted to 27,973 rix dollars.

The substance which remains after the oil has been extracted from *copra* is called *taur*, which serves well to feed pigs, poultry, &c.

Ceylon exports annually a great quantity of coco-nuts, chiefly to India. In 1809, the number amounted to 2,977,275. The medium price may be stated at about 3s. 6d. per hundred, or nearly one halfpenny a-piece. According to Koster, the value of coco-nuts in Brazil is about 6s. 6d. per hundred, or a little more than $\frac{7}{10}$ths of a penny each. In Ceylon they pay an export duty of 5 per cent. These nuts are sometimes brought to this country from the West Indies. The captains of ships use them instead of wedges of timber to fill up the vacua between the casks and other packages which compose their cargoes. On this account, the freightage of the nuts adds little to their original value. They are therefore, now said to be as common in the shops and streets of London as the orange.

Coco-nut oil may be exported from Colombo, at about 1*s.* 6*d.* per gallon; and, at this price, a large quantity is annually sent to different parts of India. In Java, where it is an article of importation, the market price is usually about six Spanish dollars a-picul, which is equal to about 1*s.* 9*d.* per gallon. Within these few years, it has been imported into Great Britain, where the same quantity has been sold as high as from [illegible]. The quantity exported from Ceylon, in 1813, amounted to 27,265 measures, each measure about two pints; value in rix dollars 7952.

In this country it has been employed as a lamp-oil, and in the manufacture of cloth, instead of olive-oil. Soap and excellent candles are made of it; and the glass-blowers are said to prefer this oil to all others in their operations.

Hitherto the importation of coco-nut oil into Europe has been attended with much waste by leakage, in consequence of having been imported in casks, the wood of which permits the contents to pass through in large quantities. Between the tropics, the temperature of the cabin or cuddy of a ship, is frequently as high as from 85° to 90° Fahren.; that of the hold must be considerably higher. Coco-nut oil does not freeze until the temperature be reduced to 72° Fahren. Hence it is in a fluid condition during the greater part of the voyage from India.

The shells of coco-nuts are manufactured into beads for rosaries. They are also used as drinking-vessels, and for various other domestic purposes. Particular virtues have been attributed to cups made of the shell of the nut. They have been supposed to give an antiapoplectic quality to intoxicating liquors. Occasionally they are polished by the natives, who cut figures in relief upon them. When thus ornamented, they are sometimes employed by the English as sugar-basins. In the neighbourhood of Monte Video, in South America, the ladies drink an effusion of an herb called *matte* (Paraguay tea) from highly ornamented coco-nut cups. They extract the tea from the cup by sucking it through a long silver tube. The common ladle used in great part of India and in the Brazils, is formed of a part of a nut, to which a long wooden handle is fixed. In America they have even given a name to the instrument, for ladles made of silver are called *silber cocos*. By the inhabitants of some of the Oriental Islands, they are employed as a measure for both dry and fluid substances. Their capacity is known by the number of *cowries* (Cypræa moneta) they will contain. Hence there are cocos of 500 or 1,000 cowries, and so on.

In ancient times coco-nuts were even more valuable than they are now. Rochon tells us, that it was not uncommon at one period to see them sold for upwards of 400*l.* sterling. The Emperor Rodolphus the Second, could not procure one at the price of 4,000 florins, They are now more generally diffused than formerly, and consequently much less valuable.

The tree sometimes bears fruit in five or six years from the time it is transplanted from the seed-bed; but the produce is rarely abundant before the eighth or ninth year. It continues to yield fruit for sixty or seventy years! In good soils, and particularly during wet seasons, the tree blossoms every four or five weeks; hence there are generally fresh flowers and ripe nuts on the tree at the same time. There are commonly from five to fifteen nuts in a bunch; and on good soils, a tree may produce from eight to twelve bunches, or from 80 to 100 nuts generally.

MANUFACTORY REGULATIONS.

Gentlemen;—The relation between employers and employed, duly considered and rightly appreciated, will tend more to their mutual advantage than any legislative enactments upon this subject. In visiting various manufactories in this and other kingdoms, I have been struck with the different modes by which they have been conducted; and it appears to me, that a review of them, for practical purposes, would deserve a place in your highly interesting Publication. If it should appear so to you, I shall occasionally send to you a few observations that have occurred to me in the course of my travels; for, though my pursuits have been more directed to science than the arts, yet I have been made sensible, by long experience, how much they may be mutually benefitted by a greater degree of intercourse with each other, and their joint co-operation.

In visiting a capacious manufactory the other day, my eye was caught by a paper containing the regulations to be observed by all persons employed in it; and from the good sense which pervades them, I was induced to request the favour of a copy from the proprietor of the works, with the express purpose of transmitting it to you. It accompanies this letter; and by inserting it in your Magazine, I flatter myself that it will suggest many useful reflections to your readers.—I remain, Gentlemen,

Your very obedient

Digamma.

[We shall be glad to hear further from our correspondent.—Edit.]

General Regulations to be observed by all the Workmen employed in this Manufactory.

1st. THAT every man shall work throughout the whole year ten hours and a half of actual time for a day, after all deductions for meals shall be made, and that all overtime must be estimated by that standard: every man must be punctual in his attendance at the hours appointed, both for the commencement of work in the morning, and at all subsequent periods during the day; but should he, from any unavoidable cause, be prevented so attending, not more than five minutes beyond each specified period, then no deduction shall be made; but should he be absent at any time *six* minutes, and not exceeding *twenty minutes*, then a quarter of an hour will be deducted, and so on for all deficiencies during the day. Every man must go immediately to work on his reaching the station assigned to him. A correct account of the time of each workman will be kept, subject to the direction of this regulation, and the amount of which, according to his stipulated wages per week, will be paid him every Saturday night. Punctuality of attendance in this Manufactory will save much trouble, and be sure to produce respect and good-will between the employer and employed.

2nd. Footings, as they are termed, are, in every point of view, a silly, ungenerous, and oppressive practice, and ought to be discontinued, inasmuch as they inflict a severe tax on those who pay them, without rendering any service to those who receive them. You will, therefore, by abolishing them, act a liberal part to the needy and distressed among you, and each of you will derive an advantage by their suppression, besides producing a reform which will meet the hearty concurrence of your employer: therefore, for these reasons, Footings are abolished in this Manufactory.

3rd. No refreshments can be admitted into this Manufactory but at the appointed periods, from eleven to half-past eleven in the morning, and from four to half-past four in the afternoon; and every man's beer or refreshment must be left and taken at his working place. None but one public-house can be allowed to supply this Manufactory at a time, and which a majority of three fifths of the men may appoint or change as they see necessary. No larger measures than pints can be introduced into it; as the object of allowing beer to be brought into this Manufactory is to afford seasonable and judicious refreshment, and not to give an opportunity for lavish and indiscreet expenditure.

4th. No workman, or other person employed in this Manufactory, can be allowed to leave his work but at the appointed periods of quitting the shop, except some member of his family wants him on urgent business, and such must apply at this Manufactory instead of the public-house from which it is supplied with beer: and all applications from the public-house having a tendency to induce any man to quit the shop but at the regular periods, will have the effect of having such applications disregarded, and the publican, for allowing them, will forfeit all right of supplying this Manufactory with any of his commodities after such is made known to him.

5th. Every man who shall be called upon by his employer to work out of the shop, shall be allowed a shilling a day, or six shillings a week, over and above his wages, provided the job be upwards of three miles from the shop, for his lodging and other expenses; and for all distances less than three miles no such allowance to be made. Each man will however be paid for his time, according to his wages, for walking at the rate of three miles per hour to the job. Every man working out of the shop must produce on a Saturday night, before he can receive his wages, a written certificate, signed by the proprietor of the job, or by some accredited person on his behalf, for the actual time he may have worked during the week, subject to the conditions of this regulation.

6th. It is positively enjoined, that each workman in this Manufactory shall provide himself with a two or three-foot rule, of which he shall be in regular possession while in the shop, and on his rule shall be marked his christian and surname. This regulation is adopted from a long and painful experience of the loss of time, and the many ill consequences which have resulted from the men having been unsupplied with this trifling, but very necessary article in this Manufactory for the dispatch of business.

7th. A general deportment of good conduct is expected from each workman towards each other, and from all together to their employer, which will operate to make them comfortable in this Manufactory.

8th. Any person in this Manufactory taking or using any tool assigned to the use of another, without first obtaining his consent, or who shall attempt to pick any lock or use any force to open any drawer, cupboard, or other implement having a lock, without the directions of *Alex. Galloway* so to do; or who shall strike his fellow-workman under any provocation except resisting a blow, shall forfeit every time for each of these offences, Two Shillings and Sixpence. Any person swearing or using indecent language, or attempting to quarrel in this Manufactory, shall forfeit for every offence, Sixpence, or who shall refuse to pay any established fine for any declared offence, shall also incur the additional penalty of One Shilling.

9th. As order and cleanliness essentially contribute to the comfort and interest of the employer and employed, it is therefore ordered that every person in this Manufactory shall clean down his bench, lathe, or other machine at which he is at work, every Saturday evening on the ringing of the bell, or forfeit Sixpence; and to put his moveable tools into his drawer under lock, and all general tools he must deliver to the appointed person of the particular department to which he belongs, or he will incur the fine of Sixpence.

10th. Any man not returning to the shop after breakfast or dinner, without making his intention of so doing known at the counting-house, and leaving his key, shall forfeit Sixpence.

11th. All fines shall be exclusively appropriated to the fund for the relief of the sick in this manufactory.

12th. Windows to be paid for by those who break them; but should they not be detected, then the man in whose boundary the broken window is found, shall be answerable for the repair.

13th. All local regulations for the management of any particular department of this Manufactory are especially to be observed by those to whom they are addressed, and not to be violated by any others, as every offender will be liable to the established fines, as well against a local as a general regulation.

14th. Every workman and every labourer employed in this Manufactory shall be requested to subscribe, the former Sixpence, and the latter Threepence per Week, to the Sick Fund, which shall entitle each in the event of illness, to relief proportioned to the state of the Fund, and the rate of subscription, which shall be governed according to such written regulations as may be adopted and approved by the majority of subscribers. ALEX. GALLOWAY.

EXPEDITIOUS METHOD OF THAWING WATER-PIPES.

Brill-row, Somers Town.

GENT. ;—The purport of this communication is to introduce (previous to next winter) a plan which I consider will be of very great utility in this, or any town where the water is laid on in pipes. I have felt the inconvenience of having the pipes frozen, and consequently of being deprived of the usual supply of water: to prevent this, I have devised a simple plan, by which a pipe, when frozen, may be thawed in a very short time. Let two small pipes be twisted spirally round the service-pipe, the whole length, from its entrance in the house to the main pipe; the two small pipes that are thus twisted round the service-pipe must be connected together, so as to have a free passage: let the other ends of the twisted pipes be then turned, one up and the other down, say a foot (perhaps if the upper one were much longer it would be better): the under one must have the half of a union joint soldered into it; the other half of the union joint must be fixed to a cone-topped stove, large enough to admit a double handful of charcoal. At the top end of the other twisted pipe there should be a cock, to prevent water from getting accidentally into it. When the water-pipe is frozen, screw the stove on with the union joint; light the fire, and open the cock on the upper pipe: the twisted pipe serves as a chimney for the stove, the warm air from which will quickly thaw the water-pipe, &c.

Yours, &c.

FRANCIS JACKSON.

IMPROVEMENT OF CANAL NAVIGATION.

GENTLEMEN;—I some months since devised a plan for impelling barges on canals by steam; and not being provided with the pecuniary means to render this improvement available to my personal advantage, I beg leave to offer it for your very useful publication.

I propose that one wheel should be affixed to the stern of the barge, protruding a sufficient length to be clear of the rudder, and extending the whole breadth of the vessel's stern; this wheel to be worked by one engine, fixed towards the after-part of the vessel.

Since I first sketched a plan of this improvement, I have read in the papers of some person having applied something similar to a passage-vessel; but I shall not fear any imputation of having borrowed my method from that person, because I could, if it were necessary, bring forward respectable persons who have seen mine long since: this, however, is of little consequence; my present object is to draw the attention of the public to the possibility of doing away with the present mode of canal navigation by horses, which is both slow and expensive: should mine be brought into practice, I presume it would be found that a barge might be sent with forty tons of goods from London to Liverpool in sixty hours, at an expense of about 10*l.*

Such of your readers as are inclined to try an experiment, may obtain further elucidation from, Gentlemen,

Your humble servant,

R. J. M.

ANSWERS TO INQUIRIES.

No. 49.—PURIFYING GOLD.

2, Charlotte-street, Sadlers' Wells.

GENTLEMEN;—The following information is, I apprehend, that which your correspondent "Niloc Esor" is inquiring for, and which I have delayed sending till now, in the hope that some one more competent than myself would have supplied it. To render this as intelligible as possible, I shall describe how I should act with a quantity of common gold of different values. I should first melt the pieces together, and cast them into one ingot, from which I should obtain a parting assay; that would show what amount of fine gold and fine silver is contained in a pound troy of the ingot; then reduce the ingot, by flatting, to the thickness of strong writing-paper, anneal it, for the purpose of making it clean, cut it in pieces about half an inch square, introduce the pieces into a straight-necked retort, pour a sufficient quantity of aqua-fortis, slightly diluted with water, into the retort, to cover the metal (stopping the mouth of the retort *partially*, with twisted paper, to prevent the too free escape of the evaporation), place a basin, half-full of dry sand, over a slow charcoal fire, put the retort into it, and there let it remain until the metal is completely dissolved, adding more aqua-fortis, if necessary, to keep up the effervescence. I would then fill the retort with warm water, which must be gently poured off into a glazed earthen vessel, leaving the sediment at the bottom of the retort; this must be repeated, perhaps twenty times, until the water come off quite colourless. The precipitate matter must then be carefully washed out of the retort into a smooth basin with a lip, as much of the water poured off as possible, and the sediment removed into a crucible; should any of the sediment remain in the basin, it may be soaked up with a small piece of linen rag, which may be put in the crucible; when almost dry (which may be expedited by placing the crucible on or near a slow fire), as much pounded pearl-ash as will cover the sediment, and about half an inch in depth, must be placed in the crucible, which must then be subjected to a gradually increasing heat in a blast furnace, until the precipitate be completely fused, when it may be cast into an ingot, or allowed to cool in the pot, which is the method I generally adopt. As in all the gold worked by jewellers there is some portion of silver, I never wash the precipitate very closely, preferring rather to retain some of the silver, than run any risk of washing away the gold; but care and practice will produce it pure.

The silver which is held in solution in the water is next to be obtained. The glazed earthen vessel which contains all the washings, should be a large pan, with a small round hole, about two inches from the inside bottom, which, till wanted, can be plugged up with a wooden peg. Into the solution throw a red-hot plate of copper, about the sixteenth of an inch thick, and at least half the size of the bottom of the pan; let it remain *undisturbed* for two days, at the end of which, drop two or three grains of common salt into the liquid; and if there is no appearance of cloudiness in the water they pass through, the silver is all precipitated. The water must then be drawn off at the little hole, giving the opposite side of the pan a gentle elevation to clear off as much of the water as possible; then plug up the hole again, fill the pan with clean water, and wash the silver off the plate of copper; removing which, rub the precipitate well between your hands in the water, to separate it from the acid, which may still cling to it; leave it to settle, which it will soon do; then pour off the water, and proceed as with the gold precipitate. The copper may then be obtained by the introduction of an iron-plate; but from the smallness of its value, I have never been tempted so to do, except for the sake of the experiment.

The information given by your correspondent "Rose Colin," though strictly true, is not, I imagine, that which Niloc Esor seeks for. The mode I have pointed out has, I believe, been in use for centuries; but that there may be a better, or that there may be an improvement on this, I have little doubt; and I hope that those acquainted with either, will promote the cause of Science, by giving to its votaries all the advantages in their power through the same medium.

I am, Gentlemen,
Your obedient servant,
G. Stacey.

No. 44.—TEMPERING IRON.

Gentlemen;—In reply to the query of your correspondent Z. Y., as to the inequality of the temper of iron, I beg to say, that the mode he has adopted of making new iron from old scraps, sunk in a charcoal finery, is quite at variance with the possibility of obtaining his object of procuring soft or regular iron.

Let him select good gray pig-iron, equal and regular in quality, and refine it; then work it under the hammer into a bloom or billet, and if proper care be taken, it will give him a regular good and soft iron, fit for most purposes to which charcoal iron is applicable; if, however, it is wanted for some very particular purpose, where any admixture of tough with bright iron would be objectionable, let him stamp his charcoal lump under the hammer to half an inch in thickness, and immediately emerge it into a bosh or cistern of cold water; and afterwards ribble, or break it under the hammer *cold*. When broken with a sledge hammer into small pieces, the bright and tough may easily be selected, and worked separate into blooms, and rolled. This will give your correspondent all he wishes.

Yours respectfully,
H. D.

No. 46.—FLAVOUR OF BRANDY.

Gentlemen;—In answer to the inquiry of your correspondent in your 48th Number, as to what is used to give the flavour to brandy, if he means the best brandy of France, which is Cogniac brandy, I must tell him that no artificial flavour is requisite, as the brandy has all the delicate, pure, delicious flavour on coming from the still. As a proof of this, I would recommend him to taste it in this state, which he may do at any of the principal importers of brandy, where he will find it with no other colouring matter but what is extracted from the wood of the cask, and in which state it is drunk in Paris, and in other parts of France. John Bull, however, must have his humour, and therefore it is coloured for him with nothing worse than burnt sugar; but if the inquirer wishes to know what is used to flavour that abominable compound called British brandy, "I could a tale unfold," but that I have a high respect for certain individuals, called distillers, chemists, and others whom such an exposure might injure; but, as Hamlet says,

"They do but jest, poison in jest;
No offence i' the world."

I am, gentlemen,
Your obedient servant,
Bibo.

INQUIRIES.

No. 53.—CLEANING MARBLE.

How can the polish of marble tables, when water, tea, &c. has been spilt on them, be restored?

No. 54.—BORING FOR WATER.

Will the system of boring for water answer in the neighbourhood of chalk hills?

No. 55.—COAL-MINE QUERY.

Cadoxton, Juxta Neath,

GENTLEMEN;—I beg leave, through the medium of your valuable work, to propose the following question, not doubting but its discussion will develop much useful information to many persons interested in coal properties.

There shall be two veins of coal, one nine feet thick, and the other four feet thick, whose local situations are exactly similar, both having good roofs or tops, each vein lying under twenty acres of land. I require to know what quantity of coal can be worked from each separate vein, and which of the two veins can be worked with the greatest profit, both to the lessor and the lessee, both paying the same royalty, and admitting each cubic yard to weigh 100 lbs.

A YOUNG COLLIER.

NEW PATENTS.

To William Harrington, of Crosshaven, in the county of Cork, esquire, for his improved raft for transporting timber.—15th June—6 months.

To Charles Chubb, of Portsea, Hampshire, ironmonger, for his improvements in the construction of locks.—15th June—2 months.

To Benjamin Ager Day, of Birmingham, Warwickshire, fire-screen maker, for certain improvements in the manufacturing of drawer, door, and lock knobs, and knobs of every description.—15th June—2 months.

To John M'Curdy, of New York, United States of America, but now of Snow-hill, London, esquire, who, in consequence of a communication made to him by a certain foreigner residing abroad, is in possession of an improved method of generating steam.—15th June—6 months.

To Philip Taylor, of the City-road, Middlesex, engineer, for certain improvements in apparatus for producing gas from various substances.—15th June—6 months.

TO CORRESPONDENTS.

T. M. B.—W. G.—J. E.—and P. Y. on the London Mechanic's Institution, have been received; but we must defer the subject for a week. We shall only say at present that we have "insinuated" nothing that we are not fully prepared to substantiate when the proper occasion arrives.

We beg to refer *Quivox*, who wishes to know which of the Committee of Managers go out of office in September next, to the 72nd of the Rules and Orders, where he will find it provided that "The thirty committee-men shall also be elected for one year, and no longer, with the exception of those for the first year, of whom the *last fifteen on the list* shall go out of office on the first Tuesday of September, 1824, and be replaced by fifteen new committee-men to be then elected for the year ensuing." The last *fifteen on the list* are, of course, the fifteen who had the smallest number of votes, a statement of which will be found in our 17th Number, page 264.

T. G.'s paper has been forwarded as directed, not that we pronounce it "unworthy of insertion," but that we may abridge, as far as possible, the controversy to which it would lead.

T. M. B. will accept our best thanks for the sample of the instrument which he has so obligingly transmitted to us. It shall be left as directed, as soon as a drawing of it is made.

Communications received from D. to Quodlibet—Troublesome Tony—Nagthorn Copcake—The Corn-flour and Bread Company—W. H. D.—Scribotinto—A Constant Reader—A Seaman—G. Thurnell—North Star (whose duplicate of the same communication never came to hand)—E.—Bisinnth—W. D.—Philo-Liverpool—Dr. Gilchrist—R. Cartwright—A. B.—Mary—Dominie—John Square—F.—Q. in the Corner—Johnson—Semiquaver—Dr. Smith—Preceptor—Previous Question.

ERRATA.

In the paper of Mr. Easley, p. 334, last sentence, for those employed in *proving* gun-barrels, read *browning* gun-barrels.

P. 299, col. 2, line 16 from top, for 148 inches, read 138.

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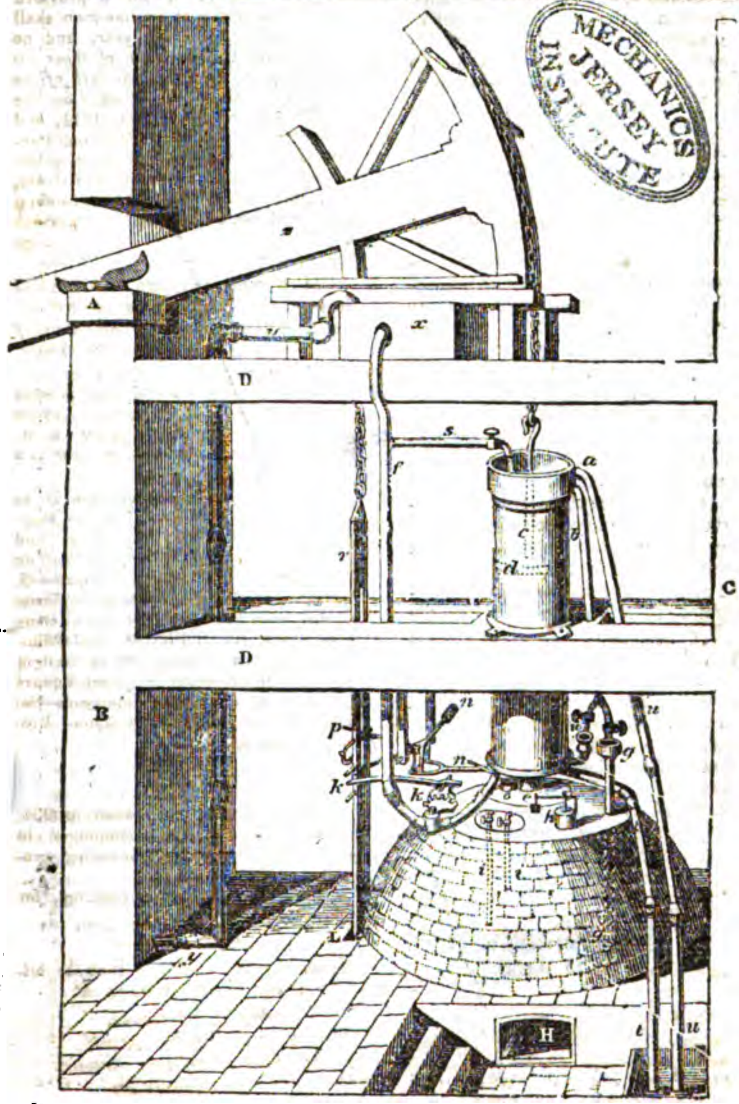
Mechanics' Magazine,
Museum, Register, Journal, & Gazette.

Crafty men contemn studies, simple men admire them, but wise men use them.
Lord Bacon.

No. 51.] SATURDAY, AUGUST 14, 1824. [Price 3d.



Descriptive History of the Steam-Engine, by ROBERT STUART, Esq. *Civil Engineer.* 1 vol. 8vo. *Illustrated by Engravings of Forty-seven Engines.* Price 8*s.*

WE have much pleasure in bringing under the notice of our readers the volume before us. It is at once the best and the cheapest account of the steam-engine that has yet appeared. Hitherto the facts of its history have lain so widely scattered, or when partially collected, have been retailed at so great an expense, that they have remained quite beyond the reach of those classes who, from being engaged in the construction of machinery, and in directing its operations when applied to manufactures, have naturally a greater interest in a knowledge of such facts, and by knowing them must be more likely to introduce and promote new improvements than any other body of men whatever.

Mr. Stuart remarks, with great truth, that all that has been done by merely learned men, in the application of steam as a moving power, is of no practical "mark or likelihood." Twenty years ago, Hornblower observed that "the most vulgar stoker may turn up his nose at the acutest mathematician in the world, for (in the action and construction of steam-engines) there are cases in which the higher powers of the human mind must bend to mere mechanical instinct;" and the observation applies with greater force now than it did then. We know not, therefore, how the remark has originated, or what "philosopher" first claimed, for theoretic men, any part of the honour of being instrumental, even indirectly, in the perfecting of the steam-engine; or who gave currency to the phrase of its "invention being one of the noblest gifts that Science ever made to mankind." The fact is, that science, or scientific men, never had any thing to do in the matter. It was a toy in the hands of all the philosophers who preceded Savery, and it again must become a toy before the speculations of Bossut, the ablest and atest of the philosophers who have written on the subject, can be made to bear upon it. Indeed there is no machine or mechanism in which the little that theorists have done, is more useless. The honour of bringing it to its present state of perfection, therefore, belongs to a different and more useful class. It arose, was improved, and perfected *by working mechanics,* and by them only; for tradition has preserved to us, the fact of Savery having begun life as a working miner;—Newcomen was a blacksmith, and his partner, Cawley, was a glazier;—Don Ricardo (Mr. Richard) Trevithick, was also an operative mechanic;—and so was the illustrious Watt, when he began and after he had made his grand improvements."

Mr. Stuart commences his history with an account of Hero, of Alexandria's engine, which is nearly similar to that given of it in our 25th, 26th, and 27th Numbers. "No other notice," he says, "of steam as a first mover occurs in the works of ancient authors, nor in modern writers, until about the year 1563." So it has been customary to state; but we can mention one *modern* instance, at least of a date more than five hundred years older, where it is distinctly recorded to have been applied to machinery. In Malmesbury's History we meet, under the date of 1002, with the following paragraph: "In the church of Rheims are still extant, as proofs of the knowledge of Gerbert, a public professor in the schools, a clock constructed upon mechanical principles, *and an hydraulic organ, in which the air escaping in a surprising manner, by the force of heated water,* fills the cavity of the instrument, and the brazen pipes emit modulated tones, through the multifarious apertures." This we incline to think was the earliest *modern* application of steam; and we are rather surprised that it should have been so long overlooked.

In 1563, one Mathesius hinted at the possibility of constructing an apparatus similar in its operation and properties to those of the modern steam-engine. About thirty years after that period, a Whirling Oelipile was described in a book printed at Leipsig. It consisted of a globe with two necks, or outlets on opposite sides; a small quantity of water was introduced into it, and rarefied into steam by a fire made under it; the vapour issued then at the two necks, and by its reaction a continuous motion was generated.

In 1624, Solomon de Caus, a French engineer, described an engine acting by the elasticity of steam; but the first person who in modern times applied it on any scale, to a useful practical purpose, was Giovanni Branca, who resided at Rome in the beginning of the seventeenth century. A description of his engine (which was only an improved Oelipile) from the pen of Mr. Partington, has already been given in our 9th Number. Mr. Stuart adds, with truth, however, that to the merit of a *first idea*; assigned to him by Mr. Partington, Branca has no claim.

The elasticity of the vapour of water, which had now become familiar to water-work artists, was applied by them in a variety of ways to their favourite problem of raising water above its level in jets and fountains.

Mr. Stuart describes two of these *Air Engines*, as they were called, but very prudently, "without vouching for the great effects" said to have been produced by them.

Bishop Wilkins, in his Mathematical Magic, 1648, speaks of the Oelipiles as if in his time, and in England it had been extensively applied to useful purposes. "These are frequently used," he says, "for exciting and contracting of heat in the melting of glasses or metals.* They may also be contrived for sundry other pleasant uses; as for moving the sails in a chimney corner; the motion of which sails may be applied to the turning of a spit, or the like."

We come next to the pretensions of the Marquis of Worcester, who, of "all those whose names are associated with the history of the steam-engine in its infant stages, is by far the most celebrated."

Mr. Stewart differs from all the writers who have preceded him in his estimate of the Marquis's merits; he scouts the idea of his having invented the engine, and thinks him merely entitled to "*some mention*, as the probable projector of an improvement in it."

Since the performances of Hero, De Caus, and Branca have been brought to light, there can now be no doubt that the claims of the Marquis have been overrated; but not certainly to the extent represented by Mr. Stewart, whose acuteness on the subject is more to be admired than his liberality. Intending in an early Number to enter upon a full review of the whole of the Marquis's Century of Inventions, we shall defer till then the farther remarks we have to make on this part of Mr. Stuart's volume.

The author next describes the successive applications of steam, attempted by Sir Samuel Morland (1682), Papin, Amonton, and Savery; to all of whom, particularly the last, full justice is done.

"In his address and explanations, Savery proceeds with all the candour and earnestness of a man, conscious of having made a discovery of immense importance to mankind; and there is no greater instance of so open and candid an appeal to experiment, and an examination of the actual performance of an engine as a test of its merit in the history of mechanical inventions.

* * * * * * *

"This engine Savery applied for raising water for palaces, gentlemen's seats, draining fens, and supplying houses with water in general, and pumping water from ships; and he erected many of them in different parts of England. The power of his engine he limited only by the strength of the pipes and vessels; 'for (he says) I will raise you water 500 or 1,000 feet high, could you find us a way to procure strength enough for such an immense weight as a pillar of water that height.'

* * * * * * *

"The advantage derived from the use of Savery's engine, as a substitute for manual labour, was counterbalanced in public opinion by the great risk of accident from an explosion of the boiler;

* An authority, by-the-bye, in favour of our Goldsmith's Apprentice Steam-Soldering Machine.—See p. 273, Vol. II.

for, during the term of his patent, it does not appear that he availed himself of the security arising from the use of Papin's Saftely Valve. * * * Various attempts were made to strengthen the boilers, by radiating arms fixed in the inside, but without any successful result: so that, at this period, the only use to which Savery's apparatus could be applied with safety, was to raise water to heights not exceeding 30 or 32 feet—a virtual abandonment of its pretensions as a mine-draining power, which was the grand object of all Savery's exertions"

Then came the improvements of Newcomen the blacksmith, and Cawley the glazier, who "made the experiment of introducing *steam* under *a piston moving in a cylinder and formed a vacuum, by condensing the steam by an effusion of cold water on the outside of the steam-vessel; so that the weight of the atmosphere pressed the piston to the bottom of the cylinder*. This was the first form of the atmospheric-engine, the simplest and most powerful machine that had hitherto been constructed."

Still many inconveniences remained to be removed; and not the least was the necessity of employing boys or men to open and shut some of the cocks; for although the risk of accident from the explosion of the boiler might now be considered as obviated, yet the effect of the engine depending much on the condition of its parts, and these being rarely deranged by slight irregularities in their action, the danger of injury to the machine itself was considerably increased from the ignorance or carelessness of the attendants.

The mechanism for opening and shutting the cocks also remained perplexed by latches and strings until Mr. Henry Beighton, an engineer, extensively employed in the construction of machinery, erected an engine at Newcastle-on-Tyne in 1718, in which all these "cock-boys" and complication of cords were superseded by a rod suspended from the beam which operated as a mechanism invented by him called *hand-gear;* a contrivance, with some slight modifications, employed in engines of the present day. It would also appear that the steel-yard safety-valve was first used in the boiler of this engine, having been suggested to Beighton by Desaguliers.

Mr. Stuart's description of Beighton's engine we shall quote at length; as it will not only give our readers a complete idea of its most approved form of construction at that period, but show more clearly the value of the improvements introduced by that ingenious engineer.

For the use of the illustrative engravings, we are indebted to the kindness of Mr. Stuart, whose ability as a draughtsman is not the least of his merits.

"The cylinder of the Griff Engine was 22 inches in diameter; and Beighton calculated that it contained 113 gallons of steam at every stroke, equal to about 14,464 gallons per minute, which was produced from about five pints of water; and this quantity was equal in its performance to three-fourths of the atmospheric pressure; so that, making allowance for the friction* of the piston, levers, and other parts, about eight pounds of water was raised by each square inch of the piston.

"In examining the seventeenth (our first) figure, which is a view of the Atmospheric Engine as improved by Beighton, it will be seen, that, in addition to the hand-gear, he gave a better arrangement and form to the parts already in use, and paid more attention to the proportion of the parts among themselves, and to the work which they had to perform; besides introducing greater neatness and accuracy of workmanship into his engines than had been attempted by his predecessors.

"In the seventeenth figure, the cistern, *x*, for the supply of injection water, is placed as in the previous engravings, and water is pumped into it by a small pump connected with the pipe *y y*, leading from the mine. (The lever beam, *z*, is not continued on the pump side beyond its axis A, as this would have required our figure to have been drawn on a scale much too small for being distinct.) To make the piston, *d*, air-tight, a ring or piece of match† is

* "Tallow was used in these engines to lessen the friction, but not to keep them air-tight."

† "The origin of packing the piston is thus given by Desaguliers: —'Having screwed a large broad piece of leather to the piston which turned up the sides of

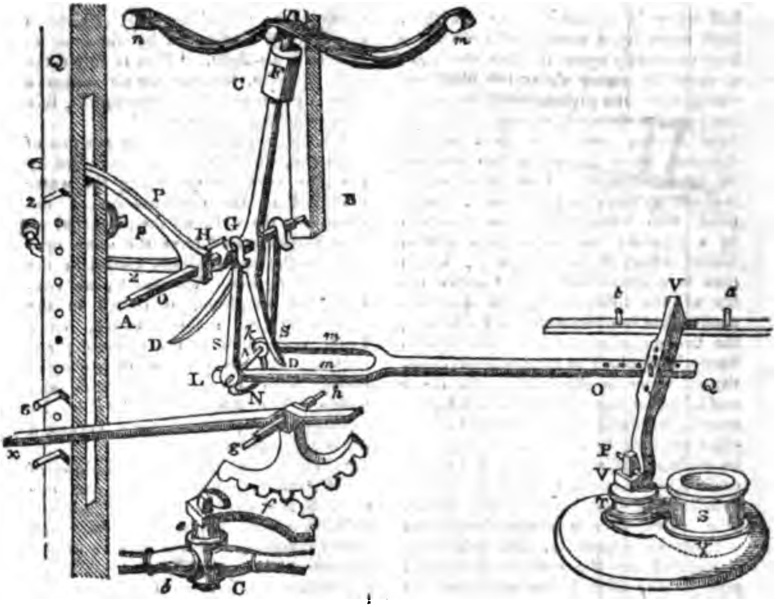
laid upon its circumference; which is kept moist by a small stream of water kept constantly running from the pipe, s, upon the piston d: a projecting rim rising above the highest point to which the piston is elevated, prevents the water from flowing over the sides of the cylinder, when the piston has reached its upward stroke. The boiler which is shown as cased in brick-work, is supplied with warm water from this rim by a pipe b; the water falls into a funnel attached to a pipe g, which rises to a convenient height above the top of the brick-work, and descends about a foot into the water in the boiler; the two *gauge-pipes i i*, are used (as in Savery's Engine) to ascertain the quantity of water in the boiler; the lower end of one is immersed for a short distance in the water—the lower end of the other reaching to within a few inches of its surface. If steam issues from both cocks when they are opened, there is a deficiency of water in the boiler; if both give water, then it shows there is an over-abundant quantity. The cold water is injected into the cylinder through a pipe *f*; and after it has performed its office of condensation, it is conducted by the pipe *t t*, and escapes through a valve at its extremity into the well or reservoir. When the water which flows from *s*, on the top of the piston, is not all used to supply the waste of evaporation in the boiler, its accumulation would soon fill the rim or cup above the piston, and flow over its edge upon the casing of the boiler. To prevent this overflow, a pipe *u u*, is inserted at *a*, which allows the accumulated quantity to fall into the well. The air which is contained in the injected water, and produced by the condensation of the steam under the piston, escapes by a small pipe *w*, to which is attached a little cup, with a valve, opening outwards: when the air is expelled by the descent of the piston, it is shut by the pressure of the atmosphere; a smal quantity of water is occasionally introduced by the pipe *h*, to keep it air-tight. 'This is called the *snifting-valve*, because the air makes a noise every time it blows through it, like a man *snifting* with a cold.'

"With the exception of the position of this valve, which Newcomen supplied by the pipe used for conveying the water produced by the condensation of the steam into the well, all the parts that we have particularized have the same operation with those similarly placed in the previous figures. The hand-gear contrived by Beighton, is shown in the eighteenth (*our second*) figure, on a larger scale than in the preceding engraving, for the purpose of giving a clearer view of its construction and action. The Atmospheric Engine, by its introduction, first properly became a self-acting apparatus.

"Between two perpendicular pieces of wood (not to confuse the figure, one only, B, is shown) there is a square iron axle, o, which has upon it four iron pieces subservient to the turning of the *regulator*, by shooting forward and drawing back the fork *m m*, fastened to the handle, V V, of the regulator T. In the perpendicular working beam, called by Beighton the *plug-frame*, there is a slit, which is contrived so that its pins work on the fore part, middle, and back part, to raise and depress the levers, *x y z*, that move the iron axle o, as much round as is necessary. On the iron axle is fixed a piece called the Y, from its resemblance to that letter, with a moveable weight F, fixed on its upper end. The *stirrup*, N, is fixed to the hooks s s, suspended on the iron axle; the levers or *spanners* are also fixed upon this axle, at right angles to the Y piece. The handle of the *horizontal fork* has holes near its extremity, for the purpose of keeping any part of the end *a*, in any part of the regulator lever V V, which moves on a horizontal bar between the pins *t a*.

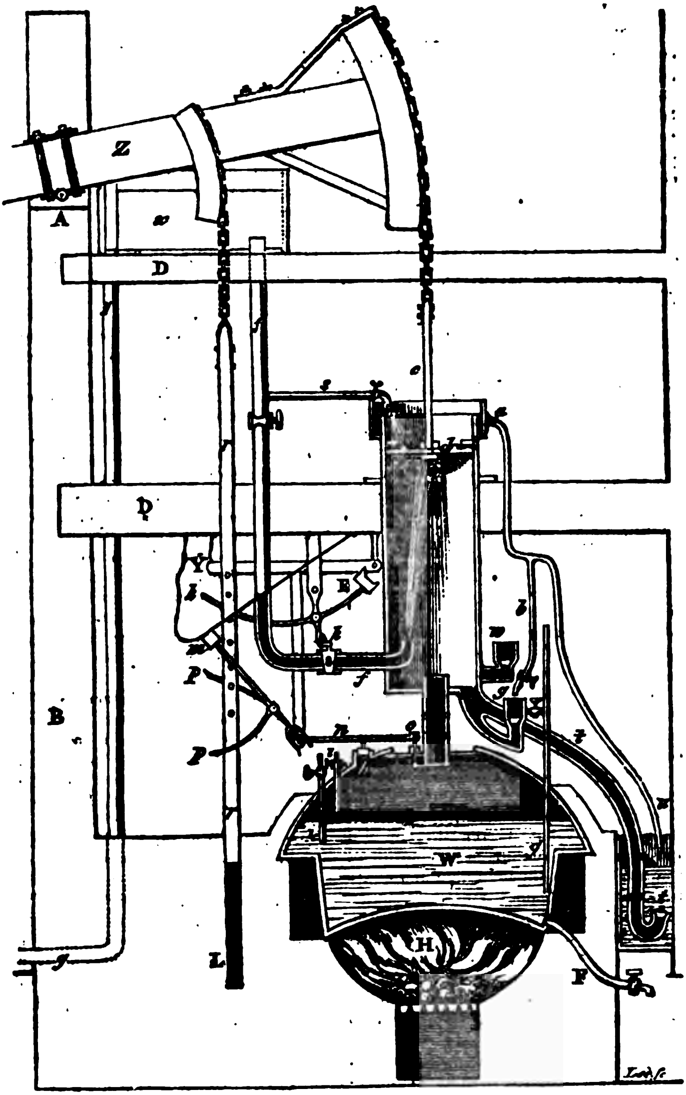
"From the situation of the apparatus, the regulator is partly open, which is apparent from the shifting plate or valve, shown by the dotted line Y, being turned from under the throat-pipe n, which communicates with the cylinder: the situation of the piston in the cylinder will be somewhat higher than shown in the seventeenth figure, consequently the lever-beam and the *plug frame* are nearly at their greatest elevation; and the pin or pulley 2, in the slit of the *plug-frame*, has so raised the lever or

the cylinder two or three inches, in working it wore through, and cut that piece from the other, which, falling flat on the piston, wrought with its edge to the cylinder, and, having been in a *long time*, was worn very narrow; which being taken out, they had the happy discovery, whereby they found that a bridle-rein, or even a soft thick piece of rope, going round, would make the piston air and water-tight.' —*Desaguliers' Nat. Phil.* Hornblower observes, 'We need not say any thing to the practical engineer about *leathering* a *steam piston*. Nor is it necessary to comment on the Doctor's acquaintance with steam and leather in contact.'—*Gregory, Mech.* vol. ii. p. 358. 1st edition."



spanner p, that the weight of the head of the Y piece is brought so far from under *n*, as to have past the perpendicular to the axle; and being ready to fall over towards *m*, its shank D, will strike the pin 4, of the stirrup, with a smart blow, and drawing the fork *m m*, horizontally towards the plug-frame, will also draw the end, *o*, of the handle of the regulator V (which slides on the bar between *t* and *a*), and thereby shut off the communication between the cylinder and the boiler. The fall of the plug-frame will reverse this motion. The moment this movement is completed, the pin 3, on the outside of the plug-frame, depresses the lever, *x*, attached to the quadrant of a wheel *g*, which moves another quadrant *f*, which is fixed on the axis or spindle of the cock, *e*, of the injection-pipe *b c*. This, admitting cold water into the cylinder, condenses the vapour, and produces a vacuum; and the pressure of the atmosphere carries the steam-piston downwards, and raises the plug-frame. The lever, *x*, is raised by another pin, which shuts the injection-cock, and depressing one of the *spanners* fixed on the iron axle, moves the stirrup and fork into the position which opens the sliding valve, and permits the steam again to issue from the boiler into the cylinder.

"The nineteenth (our third) figure is a geometrical view of the same engine, slightly varied in some of its details, and which on the whole may be considered as improvements. As its action is the same as those we have already described, an enumeration of the names of the parts will be sufficient to explain their uses. H is the fire-place under the boiler W; *i i* are the two gauge-cocks; *o*, the spindle of the regulator valve, which opens or shuts the communication between the cylinder and boiler by the *throat-pipe e*; the pipe *t t* carries the heated injection water into the well; from this pipe, a small branch *g* proceeds with a funnel-cup, having a valve opening upwards; the hot injection water passes from this into the boiler, and an additional supply is procured by the pipe *b*, from the cup containing the water used to make the steam-piston air-tight; *r r* is the *plug-frame; p p*, the *spanners*, moving the fork, and lever of the regulating valve *o*, which is constructed somewhat differently in this from the preceding figure; *m* is the *tumbling bob*, which has the same use and operation as the Y piece. The injection-cock *k* is moved by a similar contrivance of a fork acting on the end of a lever, and which is put in action by pins fixed in the *plug-frame*, to move the



spanner k; *e* is a weight or *tumbling bob*, or Y piece, to give the necessary momentum to the movement of the injection-cock lever; *s* a pipe from the cold water cistern-pipe *f*, from which a small stream constantly flows on the top of the piston; *x*, the cold water cistern; *c*, the rod attaching the steam-piston to the chain fixed to the lever beam; Z the lever beam; A, its axis; B, the wall or post which supports it; D, beams or joists to which the flanches of the cylinder are bolted; L, the groove or cavity in the floor of the engine-house, in which the lower extremity of the plug-frame moves; F, a cock for emptying the boiler; *h*, the safety valve.

(*To be continued.*)

EXPLOSIVE ENGINE.

A Mr. Samuel Brown has just constructed a very curious engine, to be employed as the actuating principle of machinery instead of the steam-engine. It is put into operation by the agency of fire, water, and air. It consists of many parts, and is not altogether free from complication; but at present we see nothing in its principles *inimical to philosophy*, and have no doubt it will act, though as to its power and operating cost, as compared to the steam-engine, we have no very favourable opinion.—*London Journal of Arts and Sciences.*

The engine alluded to in the above extract is a hydro-pneumatic one, partaking of the principles of Savery's and Newcomen's steam-engine, and also of some modifications of the same principles subsequently introduced by others; but instead of condensing steam within the cylinders to effect a vacuum, the exhaustion is here to be produced by ignited gas, issuing from jets, which, by consuming the air in the closed vessels, permits the superincumbent atmosphere to force water up tubes into the vacuum chambers, and flowing thence into the periphery of a bucket water-wheel, is thereby intended to give a rotatory power for the purpose of actuating other machinery.

A piston may be worked upon the principle of producing a vacuum beneath it, by burning the air in the way above described; and this may be done in a distinct vessel, so as to communicate with several cylinders, and consequently to work several pistons at the same time, the air and vacuum valves being opened and closed by similar means to those adapted to work the induction and eduction valves of steam-engines.

The claim of the patentee is limited to his mode of effecting a vacuum by burning gas in a vessel, and thereby consuming the air within.

The advantages to be derived from the engine above described, are stated to be—

"*First*—The quantity of gas consumed being very small, the expense of working the engine is moderate. In its application on land, the saving will be extremely great; the cost of coal gas (deducting the value of the coke) being inconsiderable; and although the expense of working a marine engine will be greater, as the gas used for that purpose must be extracted from oil, or some other body equally portable; yet even then it will not equal the cost of the fuel required to propel a steam-boat; and, as a few butts of oil will be sufficient for a long voyage, vessels of the largest tonnage may be propelled to the most distant parts of the world.

"*Secondly*—The engine is light and portable in its construction, the average weight being less than *one-fifth* the weight of a steam-engine and boiler of the same power; it also occupies a smaller space considerably, and does not require the erection of so strong a building, or of a lofty chimney. In vessels, the saving of tonnage will be highly advantageous, both in the smaller comparative weight and size of the engine, and in the very reduced space required for fuel.

"*Thirdly*—This engine is entirely free from danger, *no boiler being used.* Explosion cannot take place; and as the quantity of gas consumed is so small, and the only pressure that of the air, it is impossible that the cylinder can burst, or that the accidents incidental to steam-boats can occur.

"The power of the engine (being derived from atmospheric pressure of from nine to ten pounds on the square inch) may be increased, with the dimensions of the cylinders, to any extent, and always ascertained by the application of a mercurial gauge.

"It is scarcely necessary to allude to the well-known fact, that, after deducting the friction arising from the use of the air and cold-water pumps, &c. &c. the general *available* power of the condensing steam-engine is, from seven to eight pounds per square inch.

"The cost of the machine will be less than that of the steam-engine, *particularly as constructed for raising water*; it is, therefore, peculiarly adapted for draining fens, &c. or supplying reservoirs. The expense of wear and tear will also be trifling, and when occasionally out of order, it may be repaired at a very inconsiderable cost, and with but little delay."

READ'S BAKED EARTHEN PIPES.

Gentlemen;—In one of your late Numbers you gave an account of an invention by a Mr. John Read, of a machine calculated to water fruit-trees and green-house plants. The same person is also patentee of a species of "baked earthen pipes," luted together with Roman cement, and connected with a pump, by which he engages to raise water 30 feet, and convey it longitudinally under ground to any building or place, at a distance wherever it may be required.

Now, Gentlemen, I can state, from my own experience, that this patent invention by no means answers the intended purpose. Mr. Read fails in making his pipes air-tight; and, consequently, no water can be procured at the pump; or, if they act at first partially, they are very liable to be out of order, and cannot be depended on for an hour.

I am, Gentlemen,

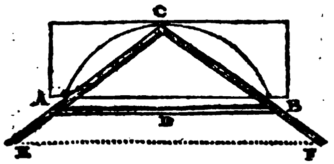
Your most obedient servant,

A Lover of useful Inventions.

DRAWING CIRCULAR ARCS AND ELLIPSES BY NAILS.

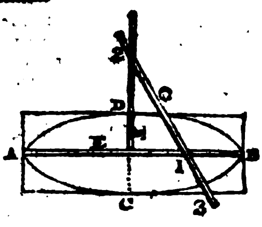
Lancaster, June 7, 1824.

1. To draw an arc of a circle whose chord is A B, and height C D.



Take two rods, each equal A B, and join them at C, where fix a tracer; extend them to A and B, and fasten them by the cross-piece D; drive nails in A and B; move the triangle of rods, and the point C will trace the arc required.

2. To draw an ellipse, of which A B is the length, and C D the breadth.



Fasten the rod E along the longer diameter, and F at right angle to it, along the shorter; take another rod G, and fix the bracer at 3; make 3 1 equal half the shorter diameter, and 3 2 equal to half the longer, and fix nails at 1 2; move the rod G, pressing the nail 1 against the rod E, and the nail 2 against the rod F, and the tracer will describe one-fourth of the ellipse. Change the rods, and draw the remainder.*

M. Saul.

ANOTHER PERPETUAL-MOTION IMPOSTURE.

A person, "just arrived from the United States of America," is going the round of our provincial towns, exhibiting, what he styles, "one of the grandest pieces of mechanism that was ever presented to the world," being nothing less than the "Perpetual Motion which was long sought for by the great Sir Isaac Newton, and since by men of all nations of the very first talents in the arts and sciences." "This grand machine" is said to have "been going ever since it was first invented, *upwards of seven years*, and will continue to work without any assistance whatever, but by the power of its own gravity, balance, and pivots, as long as the world stands; or, in other words (if the materials it is made of would last), for ever"!!! We are further assured, "that it has been exhibited in the United States, and in all the principal towns in the West India Islands; and is allowed, by men of genius, and by those who are acquainted with mechanical powers, to be one of the most wonderful and extraordinary pieces of machinery that was ever invented in the world, reflecting the highest credit on the inventor, for his patience and perseverance for upwards of fifteen years study on this invention."

The "inventor" of this wonderful wonder having lately honoured the city of Norwich with a visit—for "a short time" only, however, while he "waits the decision" of the Royal Society of London, to whom he has applied for "the premium offered by government" (there is no premium), the mayor thought proper to direct a friend in London to inquire whether Mr. Perkins knew any thing of this American prodigy. Mr. P. told the

* This method will be found of great convenience to gardeners in laying out grass plots, &c.—Edit.

inquirer that he had once actually travelled 400 miles in America to see a piece of mechanism which he believed to be similar, but that having found it to be all a deception, it had been broken to pieces by the populace.

An intelligent correspondent at Norwich, who examined the apparatus, has explained to us pretty clearly in what the deception consists; but without an engraving (which would be thrown away on such a piece of trickery), his description would not be intelligible to our readers.

It may suffice, for the information of our country friends, to mention that the concealed cause of motion is thought to lie in the plinth, and that it seems to consist of "machinery attached to the lower part of the trundle, worked by a spring like the pocket-watch." The "planes, &c. upon the wheel are mere gew-gaws, to divert the attention from the real cause."

LAND STEAM CONVEYANCE,

To supersede the necessity of Horses in all public Vehicles.

"No local interests, no partialities must be allowed to interfere; and although petty conflicts might be sustained, they must all yield to this measure of great public utility."—*Lord Liverpool.*

Nottingham, May 1, 1824.

GENTLEMEN;—As you were so kind as to insert in No. 19 the plates and writings which I transmitted you last November, allow me to call your attention, the first convenient opportunity, to the following remarks:—

The practical economy of steam-power is already so fully proved by its universal adoption in our mining districts, in our manufactories, and on board our packets, as to afford demonstrative evidence of the numerous, *but yet unforeseen,* advantages which might daily be derived from its general application to our inland conveyance.

By the establishment of a general iron rail-way in a direct line, the distance, between the capital and the manufacturing towns, and principal cities, might be reduced one quarter, and in many cases one-third, instead of the ridiculously winding course the stage and mail coaches now daily run.

The permanent prosperity which would grow out of this rapid communication would soon be felt in every corner of the united kingdom. The mails from London to Manchester, Liverpool, and Leeds might be conveyed within the space of twelve hours, and those to Glasgow and Edinburgh within twenty-four. The ordinary stage-coaches, caravans, and vehicles, for the conveyance of every description of merchandize, might also be transported on the same improved principle.

The inhabitants of London might be regularly supplied with coals, on comparatively reasonable terms, were their markets thrown open to the free competition of trade. The many disadvantages attending the coal trade in London, as at present carried on, are sufficiently apparent in the expence of vessels, Seaman's wages, protracted voyages, insurances, tonnage dues, light dues, &c.; and it should always be remembered, that vessels in this trade generally, I believe, return from London in ballast: whereas coal-waggons coming to London on rail-ways might be certain of loading on return to all the populous districts through which they would pass. One gang of coal-waggons, carrying the full freight of a vessel, might be forwarded from Newcastle to London in three days by the simple expense of one steam-engine; but the manifold benefits which this measure would throw open to the general commerce of London, and throughout the interior of the country, can only be justly appreciated when they become known and understood.

It remains only to ascertain the exact amount of capital required for the rail-way, in order to show the feasibility of this scheme; and on this head, if we reckon each *single* rail-way at two thousand pounds per mile, and allow two rail-ways for vehicles going down, and two rail-ways for those returning, the whole sum per mile would be 8,000*l.* However, in order to guard against contingent expences, let the sum be stated at twelve thousand pounds per mile, and this, I think, the most experienced engineers and surveyors will allow to be the utmost extent. The distance between London and Newcastle, in a direct line, will be about 200 miles, which, at 12,000*l.* per mile cost of the rail-way, will amount to two millions four hundred thousand pounds. Taking for a calculation the number of chaldron of coal consumed annually in London, to amount to two millions, and reckoning the toll at five shillings per chaldron for the whole distance from Newcastle to London, this branch of commerce *alone* would yield a revenue of five hundred thousand pounds to the proprietors of the rail-way, without taking into account the numerous daily vehicles of every description for the conveyance of persons, and of merchandize of every kind. The superior facilities and advantages which rail-ways would afford, when compared to our ordinary turnpike roads (with all their recent *scientific* improvements), are so apparent, that it may truly be said of the present generation, "Eyes have they, but they see not; they have ears, but they hear not!"

There are not less than ten thousand steam-engines employed daily in this country, but not one is yet applied to our inland conveyance: the many attempts made to improve still further our steam-engine, instead of a due application of its present commanding power to the purpose now recommended, must, one would hope, in time disturb the lethargic slumbers of the public, who are hourly smarting under the most oppressive tax upon the conveyance of persons, and of merchandize of every kind. Without further trespass upon your valuable work, permit me to refer your numerous readers to my "Observations on a General Iron Rail-way," (the fourth edition of which contains maps and plates illustrative of the plan). If a public meeting were convened by the wealthy merchants and capitalists of the metropolis, in order to canvass the relative properties o. this scheme, the example would soon be followed in the manufacturing districts and principal cities, and the many millions now annually squandered away in purchasing and feeding unnecessary horses, might be divided by the holders of shares in a General Iron Rail-way Company, and the numerous Branch Companies which would be established throughout the united kingdom.

I remain, Gentlemen,

Your most obedient servant,

THOMAS GRAY.

GUNTER'S LINE.

July 26, 1824.

GENTLMEN;—Several years ago I began to study mechanics and practical mathematics, not to acquire either wealth or fame, but solely for amusement. I soon met with difficulties I could not unravel, and having no idea of turning a pleasure into a toil, I quitted mechanics for more entertaining studies. Recent circumstances, however, have turned my attention to the same subject, and I have just been endeavouring to make out the use of Gunter's Line,—I mean the line of lines, which is also called the line of numbers Our Encyclopædias tell us that Gunter's Line is "only the logarithms graduated upon a ruler, which therefore serve to solve problems instrumentally in the same manner as logarithms do arithmetically. It is usually divided into 100 parts, every tenth whereof is numbered, beginning with one and ending with ten; so that if the first great division marked one, stand for one-tenth of any integer, the next division marked two, will stand for two-tenths, three three-tenths, and so on, and the intermediate divisions will, in like manner, represent 100th parts of the same integer. If each of the great divisions represent ten integers, then will the lesser divisions stand for integers; and if the greater divisions be supposed each an hundred, the sub-divisions will be each ten." The Gunter's Line which I have is inscribed on the sector of a pocket-case of mathematical instruments, and it corresponds with some others with which I have compared it; but how it is described by the above definition is what

I cannot comprehend. But it is the application of Gunter's Line which most puzzles me. One of the cases in my books is the following:—"To find the mean proportional between 8 and 32, extend the compasses from 8 on the left-hand part of the line to 32 on the right; then bisecting this distance, its half will reach from 8 forward or from 32 backward to 16, the mean proportional sought."

Where are these numbers on the Gunter? where are 32 and 16? The numbers themselves are certainly not there; nor can I make out how the figures and divisions on the Gunter can by any combination be made to express these numbers. But, perhaps, I ought not to look for the numbers, but only for their logarithms, and after having found the logarithm then find the numbers. But in what way is this to be done? and how can I depend on being accurate, particularly when the compass falls between the divisions; for the slightest difference in the value of the logarithm, will make a great variation in its corresponding number, and I must be peculiarly lucky to bring it exactly to 16. But, above all, where is the wonderful quickness of this plan? Could not the operation be performed with a pen and ink in less than a tenth of the time?

Now, Gentlemen, I dare say many of your readers think that all this is very silly, and I shall readily excuse their smiling at my ignorance; but I must request they will, at the same time, endeavour to furnish me with the requisite information through the pages of your Magazine, and I am sure that I shall not be the only person who will profit by their instructions.

UNIT.

CAOUTCHOUC.

GENTLEMEN;—Observing in your article, at page 291, on water-proof cloth (No. 47), that there exists some difficulty of procuring a solvent for caoutchouc, I would suggest, that the South Americans should be instructed to bottle the liquid as it exudes from the tree, which, if well corked, would exclude oxygen, and (if Fourcroy is right) prevent its hardening. This method (if found practicable) would not only save the time and trouble of dissolving the caoutchouc, but would most probably, from its never having been in contact with smoke or oxygen, be found to unite with many substances, for which, in its present state, it has no affinity.

If simple bottling should fail, perhaps some of your chemical correspondents would suggest the most proper menstruum, and the proportion to be mixed immediately after collecting, or to prevent its inspissating in the slightest degree; it might be made to ooze out, or distil into the very bottle containing the proper proportion of menstrua in which it is to be corked. Spirits of turpentine seem first to come to mind; at all events, it should be such as could be easily procured in the same country, and easily evaporate. Another quality, perhaps, it ought also to possess, of having little oxygen in its composition, or at least the oxygen it contains should have a greater affinity for the particles of the menstruum, than for any of which the caoutchouc is composed.

Yours, &c.

J. B. B.

THREE-WHEELED CARRIAGES.

GENTLEMEN;—Having lately effected several improvements in the construction of three-wheeled carriages from a consideration of their utility and convenience, particularly for the service of invalids and others requiring safety and ease of motion, I beg leave to inform your correspondent "P. M." (p. 334, Vol. I.), that if he wishes to have such a carriage made, and will send his address to 25, Bow Street, Long Acre, he shall be furnished with the particulars of a three-wheeled pony phæton now building for a gentleman upon the improved construction of carriages.

In answer to the objection which it is imagined there would be to them upon bad roads, the mechanical principle of a three-wheeled carriage is decidedly more favourable to safety and ease than a four-wheeled one under such circumstances, from the mode in which the wheels accommodate themselves to the action of each other on any uneven surface of ground, as the front wheel yields upon its centre to the motion or position of the hind ones, while the carriage moves on the hind axle to any ascent or descent of the fore-wheel. It likewise possesses more safety in turning, as it never loses its three bearings, the fore-wheel merely changing its *direction*, and not its *position*.

As the body is independent of the carriage, it can of course be made as easy as may be required, by attaching it with springs and braces.

The shafts can be made less likely to break, or even hurt the horse from his falling on them, by being fixed in a particular mode to the carriage.

I remain, Gentlemen,

Your humble servant,

G. M.

FRENCH POLISH.

GENTLEMEN; — Being willing to avail myself of some part of the valuable information with which your excellent work is replete, I have attempted the improvement of several articles of household furniture, by the addition of the "French polish" recommended in one of your former Numbers; but whether from not having been sufficiently careful in cleaning the articles from the preparations previously used, or from some other cause with which I am unacquainted, I have not succeeded in my wishes, being unable to produce that smooth, even polish, so much admired. Not knowing how to proceed, I have ventured to hope that some of your correspondents will, through the medium of your pages, say whether it will be necessary to remove the polish already put on preparatory to another trial; and if so, by what means this is to be effected.

Your insertion of this will greatly oblige your obedient servant,

THOMAS TITLEY.

IMPORTANCE OF SCIENTIFIC INSTRUCTION TO THE MASON AND CARPENTER.

The following passage in Mr. A. PUGIN's "Specimens of Gothic Architecture," is well deserving of attention. The work is esteemed as one of the most useful books on that subject, for practical men, that has yet been published. That part of it from which our extract is taken, is written by Mr. E. J. Wilson, of Lincoln, a respectable architect and antiquary, whose studies have been successfully directed towards the ancient architecture of this country:—

"The perfection of which this style (the Gothic) is capable, needs no comment; we have monuments in our own country which can never be equalled by any modern works. The skill displayed by our ancient architects and masons in carrying up pinnacles and spires, poising lofty arches, tier upon tier on slender shafts, spreading out fretted ceilings, and suspending pendent groins, make imitation almost hopeless. The disadvantages under which modern artificers labour, when first put to the execution of Gothic architecture, can hardly be apprehended by any one but a practical builder. Experience gradually lessens this difficulty; but until workmen can be better educated, it is in vain to expect from them proofs of skill equal to those of their predecessors. Before the disuse of the Gothic style, a fund of practical knowledge existed which had been accumulating for centuries; every variation of style included some improvement in execution, though not always a better taste; but all the secrets of art which the ancient masons possessed, are lost to us. There can be no doubt that the infinite variety, the spirit and originality observable in the knots and small carvings of Gothic buildings, are owing to their having been designed and executed by the same individuals. How poor do the flat casts, stuck about modern buildings, appear when compared to these! Such workmen must have had considerable skill in drawing; and some instruction in that art would wonderfully improve the talents of modern mechanics. In our times, the mason and carpenter are of much less consideration than they were three or four centuries back; commerce has superseded their arts, and they have fallen into ignorance. An ingenious lad, the son of a substantial yeoman, when put apprentice to a master-builder, sinks, for a time at least, beneath the rank of his family; he is hardly company for his brother, who stands six days in the week, in full dress, behind a linen-draper's counter; and yet he has chosen a profession which requires a hundred times more intellect. A sufficient distinction is not made between the mere labourer, who drudges and carries burthens, and the artificer, capable of executing the best parts of architecture. The latter ought to be encouraged to acquire a better education, and especially some instruction in drawing; and his pay ought to be proportionably higher according to his abilities: so that a clever man, though not possessed of a capital to enable him to become a master, might support himself well by steady exertion, and take a respectable place in society."

ANSWERS TO INQUIRIES.

No. 42.—REFINING GOLD.

In answer to the inquiry of "Niloc Esór," for a process for refining gold, I beg leave to recommend the following:—Dissolve the impure gold in nitro-muriatic* acid, then add sulphate of iron (or green vitriol) in solution, and a precipitate will fall; add sulphate of iron till no more of the precipitate fall; collect the precipitate, wash it thoroughly, and dry it; and in this state is pure gold. If it be wished to obtain it in mass, the precipitate may be mixed with little powdered borax, and heated in a crucible on a moderate fire; it will then be obtained in a pure and solid state. W. B.

No. 43.—THE CASE IN MACHINERY.

London, July 26, 1824.

Gentlemen;—As your correspondent "G." has done me the favour to notice my question, respecting the "air-pump and cylinder" (No. 43), I will, with your permission, advance one step farther, and state a few more particulars respecting the machine I have in view. "G." is, no doubt, a practical man; and, as such, will at once see what perhaps I, a mere theorist, should never be able to discover. "G." seems to think, if the piston could be made to ascend, even at all, by the blast, as he is pleased to call it, being admitted into the bottom of the cylinder, much, very much advantage might be obtained. Now all the advantage I ever contemplated from this blast was, the effect it would produce by at once removing the pressure of the atmosphere from the top of the cylinder, not to aid the ascent of the piston in any other way, but that the return and ascent of the piston to the top of the cylinder was to be accomplished by *another* power sufficient for that purpose. I will now state, as shortly as possible, how, and by what means, it was my intention to obtain, not only a power sufficient to cause the piston to return to the top of the cylinder, but a power equal to that which caused the piston to descend to the bottom of the cylinder.

In endeavouring to explain my ideas, it will be necessary to have recourse to weight and measure; but as to the exactness of these matters in this stage of the business, it will be seen that these points are not material.

I will then suppose a cylinder, whose superficial contents would be equal to an atmospheric pressure of 15 tons, and I will farther suppose this cylinder to be eight feet in length. Now, to the bottom of it I would have an air-pump, which, to keep it in constant motion, should require a power equal to 100 pounds weight. Then I conceive that, with this last *small* power of 100 pounds constantly applied, I could cause the large weight of 15 tons to descend to the bottom of the cylinder; but, if I understand "G." rightly, he informs me, that although I may accomplish this by such means, yet still I shall gain no advantage by such an operation; that is, that although this large weight of 15 tons would, by such means, be brought to the bottom of the cylinder, the *time*, the *friction*, and the power to work the air-pump, *all* added together, would be nearly, if not quite equal to the power I should gain by the atmospheric pressure of the 15 tons on the top of the piston; indeed, I think he says I should, in the operation, be minus. Now, this is certainly the question I sought the solution of; and if "G." is correct, it would appear no advantage can be obtained by any such means. But I will go a little further, and I hope he will then do me the favour to think a little more; I am induced to do so because he says, if I could persuade the piston to ascend, it would be a very important consideration. As I have before observed, my information upon this subject is principally confined to theory, and, as such, it has always appeared to me that a very considerable advantage, in point of power, was to be obtained, when by the application of so small a power as 100 pounds—a power equal to 15 tons, or, indeed, a much

* Nitro-muriatic acid may be made by mixing about three parts of nitric to one of muriatic acid.

greater power than that was to be gained. And farther, it has always appeared to me, that in this particular instance, there must evidently be an exception to the general rule—namely, "that what is gained in power, is lost in time." With this notion strongly impressed upon my mind, I will now state, that when I have set up the cylinder, as mentioned above, I then apply an air-pump to exhaust the air from such cylinder. As the air is by the air-pump exhausted from the cylinder, the piston will descend to the bottom; I then open a valve at the bottom, and the pressure is immediately removed from the top. But how is the piston to return to the top of the cylinder to be ready to make a second stroke? Why, the instant the piston has reached the bottom of the cylinder, and by its pressure thrown open a valve to admit the air, at the same instant a valve cuts off the communication of the air-pump from the cylinder, and the air-pump being in constant motion, its powers are then applied to exhaust the air from a second cylinder, in all respects like the first. These two cylinders must be placed at a convenient distance from each other, and the pistons working in them, must be connected by a beam or wheel. By the constant working of the air-pump, the piston in one cylinder will descend as the air is exhausted; when it reaches the bottom, it opens *one* valve to admit the air, and shuts another valve to cut off the communication of the air-pump: *this* communication remains cut off until the piston in the other cylinder reaches the bottom of such cylinder, when, as before in the other cylinder, the pressure opens one valve to admit the air, and shuts another to cut off the communication of the air-pump. Thus, by the constant working of the air-pump, the two pistons will alternately descend and ascend, and will continue to vibrate in this manner as long as the air-pump is kept in motion. Now, I have not the least doubt, if "G." will give the matter a little farther consideration, he will see that such a motion as I have attempted to describe, may be produced, and, I humbly conceive, to a very great advantage of power. If such a principle as this is good for any thing, I flatter myself I have many things in contemplation that would very much tend to improve its advantages. EPROTH.

No. 47.—CEMENT FOR "UNITING BRASS TO GLASS."

The following method is often used for making a cement for uniting different initials to glass: about three parts of common rosin and one ounce of bees'-wax are melted together in any convenient vessel. After the rosin and wax are thoroughly incorporated, about one-third of their bulk of Venetian red is added, to give it a body. The whole should be well mixed together over the fire while in the liquid state; and in that state it may be used for any purpose wanted.

It often happens that the Venetian red contains a quantity of water, and if it is added in this state to the wax and rosin, it is a long while before you can get rid of the water. The red may, however, before being mixed with the rosin and wax, be heated gently, so as to expel all the water. W. B.

No. 52.—STEEL COLOUR.

GENTLEMEN;—Your correspondent, "N. A." in "No. 52 of Inquiries," wishes to know "what are the various colours used in oil-painting, to produce the different tints of steel." It is evident he is not a regular artist, otherwise he would have put the question in a more definite manner. The colours to imitate steel, are, white-lead, black, and blue; these colours will make what would be called "a clean steel colour:" but it is impossible to say in what quantities they shall be used, because the effects of reflection, and light and shade upon polished steel, are of such a nature, that it will seem quite white in one place, and black, or nearly so, in another. Again, these colours are not always sufficient, because bright steel will oftentimes partake of any strong colour that may be in proximity with it; to represent, therefore, "rusty steel," such as old armour, or any thing of that sort, more colours will be requisite, namely, umbers, raw and burnt, and ochre. This is only speaking of "crude colouring;" but for "glazing," Vandyke brown will be found as good as any thing for most purposes. I could say a great deal more on the subject, but the best general information that I can give "N. A." is, to do as all persons must do, who ever intend to become artists, which is to *study nature*, and mix all his tints accordingly. SCRIBOTINTO.

INQUIRIES.

No. 56.

A receipt for extracting the stains of ink from ivory, will oblige

Your obedient servant,

T. M. B.

No. 57.—RAISING WATER.

A reader of your useful Journal would be obliged to any of your contributors, who would take the trouble of pointing out the most elegant mode of raising water from a pipe, in which the water already stands 21 inches, into a basin, 31 or 32 inches high, for hand-washing; the operation of filling the basin to cause as little trouble as turning a cock. Any person sending for insertion such a drawing and description as may enable the querist to accomplish the object proposed, will very likely find a notice in a future Number of a small reward. J. B. B.

SOAP MAKING, BY THE COLD PROCESS

In Virginia there is a mode of making soap, adopted by the country people, which they call the "cold process," that deserves to be made generally known. It is thus described by a farmer's wife:—"I put my barrel (a common fish-barrel) in the cellar where it is intended to stand, and fill it nearly full of strong ley; then add as much grease, without melting it, as I think sufficient, stirring it once every day or two. In a few days I can tell whether I have put too much or too little grease, and add ley or grease as the case may require. In two or three weeks it becomes excellent soap. We call it the cold process. In this way we make better soap, get rid of the trouble and risk of boiling, and can make it as suits our convenience, or occasion requires."

NEW PATENTS.

To John Gibson, woollen-draper and hatter in Glasgow, for his manufacturing or making of an elastic fabric from whalebone, hemp, and other materials combined, suitable for making into elastic frames or bodies for hats, caps, and bonnets, and for other purposes, and also the manufacturing or making of such elastic frames or bodies from the same materials by the mode of plaiting.—15th June—4 months.

To William Bailey the younger, of Lane End, Staffordshire Potteries, manufacturer and ornamenter of lustre ware, for his improved gas-consumer for the more effectually consuming the smoke arising from gas-burners or lamps.—15th June—2 months.

TO CORRESPONDENTS.

B.—An application to Mr. Perkins (Water-lane, Fleet-street) will, no doubt, procure the inspection desired. The extracts given from the pamphlet embraced every thing of importance. The chambers of the L. M. Institution are in Furnivals'-Inn.

Omega—We are, for many good reasons, fixed in our resolution.

Dr. G.'s communication we must decline; it would only make worse the cause he befriends.

R. Cartwright—We shall endeavour to procure what he desires from the patentee. An account of his self-acting machine for raising water will be acceptable.

W. H., P——r, and A Youth, will find an apparatus for a similar purpose already described in our 43rd Number.

T. J. S. had better make some further inquiry in White's-row, Spitalfields; the fact can be best ascertained there.

The hints of W. B., for which we thank him sincerely, shall be attended to.

We shall be glad to learn from B. N. where to address a letter to him.

T. M. B. on the Mechanic's Institution, in our next.

Communications received from J. Ellis—L. M., a Dabbler—J. T.—A. B.—W. H. D.—T. P. A.—W. R.—Geologos—Tyro—A Man in the Moors—An Engineer—W. E.—James Collins—A Constant Reader—A Member—Emery—Senex—P.—A Mechanic—Albert—S. Y.—A. G.—J. Horn—T. Q.—Inquirer—P. Plain—Mr. Gordon—Mr. Varley—G. Wilson—An Old Carpenter.

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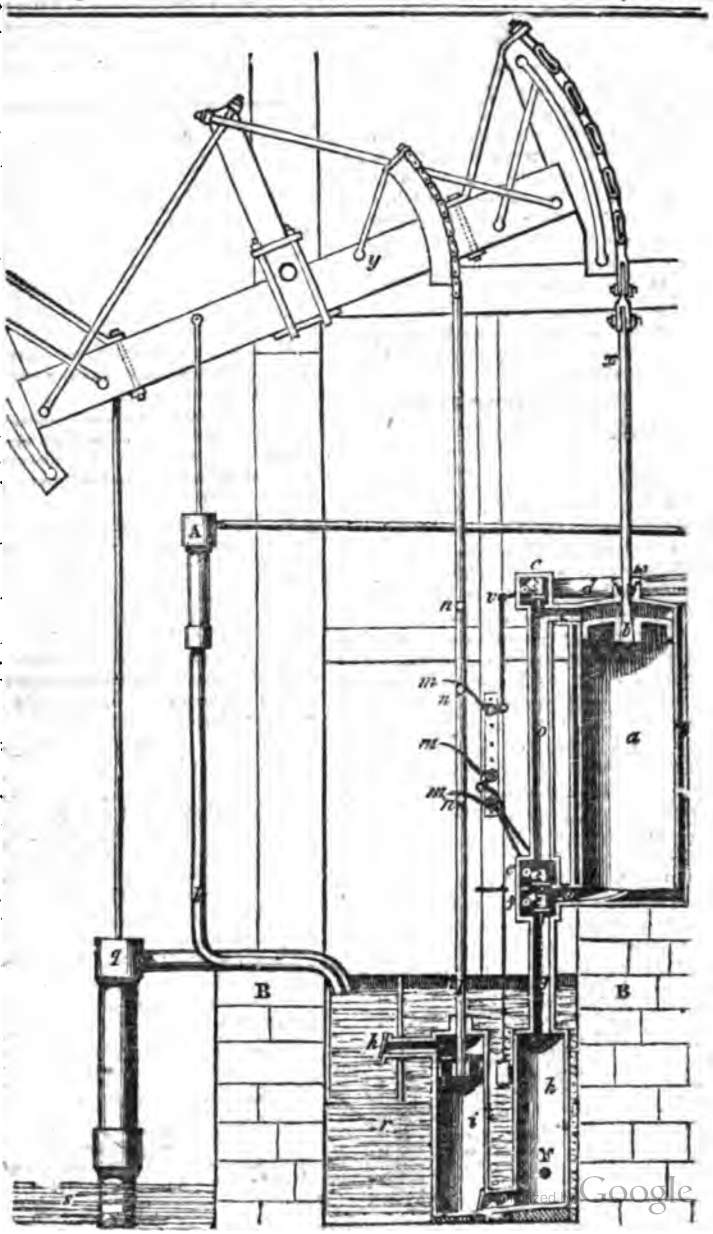
A man always makes himself greater as he increases his knowledge.—*Dr. Johnson.*

No. 52.] SATURDAY, AUGUST 21, 1824. [Price 3d.



DESCRIPTIVE HISTORY OF THE STEAM-ENGINE.

By Robert Stuart, Esq.

(Continued from our last.)

In Savery's first engines the condensation was invariably accomplished by an effusion of water on the outside cylinder. We have no authentic information at what period the high-pressure engines were constructed to condense by a jet in the inside; Mr. Stuart thinks that it was probably about 1712. In the engine which takes Desaguliers' name, the condensation by injection was improved by the water being made to fall through a cullender, in order, by diffusing the jet more equally, to get a speedier condensation. Desaguliers tells us, that he erected seven of these engines in 1707 and 1718.

In 1720, Leupold, the author of the "Theatrum Machinarum," constructed what may be considered as the first "high-pressure lever engine," in which the steam was permitted to escape into the atmosphere after it had performed the office of raising pistons attached by rods to a lever. With a candour which Mr. Stuart states with some truth, to be "unusual in the history of the Steam-Engine," Leupold ascribes the sole merit of his contrivance to Dr. Papin, as it was to him, he confesses, that he was indebted for the idea of employing the elastic force of steam to raise water. Leupold also proposed using Savery's engine to raise water by the elasticity of the vapour only. Instead of condensing the steam, he allowed it to escape into the atmosphere.

Although Mr. Jonathan Hulls did not originate any novelty in the construction of the atmospheric engine, Mr. Stuart makes honourable mention of him as having proposed the application of paddle-wheels, moved by a steam-engine, to propel ships instead of wind and sails. In this scheme, it was necessary to convert the alternate rectilineal motion of a piston-rod into a continuous rotatory one, which he ingeniously suggested might be accomplished by means of a *crank*. This is now, with justice, considered to be that invention which introduced the steam-engine as a first mover of every variety of machinery. For further particulars of Hulls' invention, we refer our readers to the description given in a former Number, Vol. I. p. 97.

After noticing several other improvements of minor importance, Mr. Stuart comes to those of Mr. Watt, his account of which we subjoin:—

"In the winter of 1763 and 4, having occasion to repair a model of Newcomen's engine, belonging to the Natural Philosophy Class of the University, his mind was again directed to the subject. 'At that period,' he informs us, 'his knowledge was derived principally from Desaguliers, and partly from Belidor. He set about repairing the model, *as a mere mechanician;* and when that was done and set to work, he was surprised to find that its boiler was not supplied with steam, though apparently quite large enough (the cylinder of the model being two inches in diameter, and six inches stroke, and the boiler about nine inches in diameter): by blowing the fire it was made to take a few strokes, but required an enormous quantity of injection-water, though it was very lightly loaded by the column of water in the pump. It soon occurred to him that this was caused by the little cylinder exposing a greater surface to condense the steam than the cylinders of larger engines did, in proportion to their respective contents; and it was found that by shortening the column of water, the boiler could supply the cylinder with steam, and that the engine would work regularly with a moderate quantity of injection. It now appeared that the cylinder being of brass, would conduct heat much better than the cast-iron cylinders of larger engines (which were generally lined with a stony crust), and that considerable advantage could be gained by making the cylinders of some substance that would receive and give out heat the slowest. A small cylinder, of six inches diameter and twelve inches stroke, was constructed of wood,*

* "'Mr. Watt's first attempt at the improvement of the steam engine, was to employ a wooden cylinder, which would transmit the heat more slowly: this had some effect, but did not answer in other respects; he was obliged to abandon it, as well as Mr. Brindley, who had before tried the same thing.'—*Farey in Rees' Cyclop.* Mr. Brindley's trial was made on a very different part; he cased his *boiler*, or rather built it with wood—not his cylinder."

previously soaked in linseed oil, and baked to dryness. Some experiments were made with it; but it was found that cylinders of wood were not at all likely to prove durable; and that the steam which was condensed in filling it, still exceeded the proportion of that which was required for engines of larger dimensions. It was also ascertained, that unless the temperature of the cylinder itself were reduced as low as that of the vacuum, it would produce vapour of a temperature sufficient to resist part of the pressure of the atmosphere. All attempts, therefore, to produce a better exhaustion, by throwing in a greater quantity of injection-water, was a waste of steam, for the larger quantities of injection cooled the cylinder so much, as to require quantities of steam to heat it again, out of proportion to the power gained by having made a more perfect vacuum; and on this account the old engineers acted wisely in loading the engine with only six or seven pounds weight on each square inch of the piston.'*

"By subsequent experiments, Mr. Watt† also ascertained that steam was about 1,800 times rarer than water. In another experiment, being astonished at the *quantity* of water required for the *injection*, and the *great heat* that it had acquired from the small quantity of water in the form of *steam*, which had been used in filling the cylinder, and not understanding the reason of it, 'I mentioned it,' he says, 'to my friend, Dr. Black, who then explained to me his doctrine of *latent heat*, which he had taught for some time before this period (summer 1764); but having myself been occupied with pursuits of business, if I had heard of it, I had not attended to it, *when I thus stumbled upon one of the material facts upon which that beautiful theory is founded.*'*

"On reflecting further, it appeared to him that, in order to obtain the greatest power from the steam, the cylinder should always be kept as hot as the steam which entered it; that when the steam was condensed, the water of condensation and the water of injection should be cooled to 100 degrees Fahrenheit, or lower if possible.

"The means for accomplishing these two grand objects did not present themselves to Mr. Watt at the moment when he had drawn those sagacious inferences; but it occurred to him early in the year 1765, '*that if a communication were opened between a cylinder containing steam, and another vessel which was exhausted of air and other fluids; the steam, as an expansible fluid, would immediately rush into the empty vessel, and continue to do so until it had established an equilibrium: and if that vessel were kept very cool by an injection or otherwise, more steam would continue to enter, until the whole was condensed.*'

"Admirable Invention!

"Thus was accomplished what had been considered impossible by all previous engineers—*the production of a vacuum* without *cooling the cylinder.*†

* "'Mr. Watt examined the hot water which issued from the eduction pipe of several of Newcomen's engines, and found it to vary from 140° to 174°, according to the load and other circumstances of the engine. He thought this might be taken as a fair indication of the internal heat of their cylinders.'"

† "Dr. Ure, in his excellent Dictionary of Chemistry, gives the following interesting account of Mr. Watt's original experiments on the latent heat of steam: 'In some conversations with which this great ornament and benefactor of his country honoured me a short period before his death, he described with delightful *naïveté* the simple but decisive experiments by which he discovered the latent heat of steam. His means and leisure not then permitting an expensive and complex apparatus, he used apothecaries' phials: with these he ascertained the two main facts,—first, that a cubic inch of water would form about a cubic foot of ordinary steam, or 1,728 inches; and that the condensation of that quantity of steam would heat six cubic inches of water, from the atmospheric temperature to the boiling point. Hence he saw that six times the difference of temperature, or fully 800 degrees of heat, had been employed in giving elasticity to steam; and which must be all subtracted before a complete vacuum could be obtained under the piston of a steam-engine.' Art. *Caloric.*"

* "Watt's account of his invention. *Robison's Mech. Phil.* vol. II. p. 117."

† "Hornblower, in his History of the Steam-Engine, says, 'About the time that Mr. Watt was engaged in bringing forward the improvement of the engine, it occurred to Mr. Gainsborough, the pastor of a dissenting congregation at Henley-upon-Thames, and brother to the painter of that name, that it would be a great improvement to condense the steam in a vessel distinct from the cylinder, where the vacuum was formed; and he undertook a set of experiments to apply the principle he had established; which he did by placing a small vessel by the side of the cylinder, which was to receive just so much steam from the boiler, as would discharge the air and condensing water in the same manner as was the practice from the cylinder itself in the Newcomenian method; that is, by the snifting valve and sinking pipe. In this manner he used no more steam than

"But if both of the vessels be exhausted, or nearly so, how were the injection-water, and the air entering with it, and also that produced by the condensation of the steam, to be extracted from them? This Mr. Watt proposed to do, by adapting to the *condenser*, a pipe, whose length would exceed that of the length of a column of water equivalent to the pressure of the atmosphere, and to extract the air by means of a pump, or to employ a pump to extract both the water and the air.

"Instead of keeping the piston tight by water, which could not be applicable in this new method, as if any of it entered into a partially exhausted and (now) *hot cylinder*, it would boil, and by generating vapour, prevent the production of a vacuum, besides cooling the cylinder, by its evaporation during the descent of the piston,—*he proposed to lubricate the sides, and keep the piston air-tight, by employing wax or tallow.*

"It next occurred to Mr. Watt, that the mouth of the cylinder being open, the air which entered to act on the piston would cool the cylinder, and condense some steam on again filling it. Then he proposed, '*to put an air-tight cover on the cylinder, with a hole and stuffing-box for the piston to slide through, and to admit steam above the piston, to act upon it instead of the atmosphere.*'

"This was his second grand improvement; and while the power of the mechanism remained untouched, the expense of fuel or waste of steam was reduced to nearly a third of its former amount; and the machine was now, properly, an engine, acting by the force of *steam*—the motive power being derived hitherto from the gravity of the atmosphere.

"The other source of the loss of heat, by the air of the atmosphere cooling the cylinder externally, which produced a condensation of the internal steam, was obviated in thought *by inclosing the steam cylinder in another of wood, or of some other substance, which would conduct heat slowly.*

"When once the idea of separate condensation was started, all these improvements, continues this admirable mechanic, were suggested in quick succession; so that, in the course of *one or two days*, the *invention was so far complete in his mind*, and he immediately began to submit them to the test of experiment.

"The model he used, consisted of a brass syringe, $1\frac{3}{4}$ inch in diameter, and ten inches long; having a cover at top and bottom of tin plate, a pipe to convey steam to both ends of the cylinder from

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was just necessary for that particular purpose, which, at the instant of discharging, was entirely uncommunicated with the main cylinder; so that the cylinder was kept constantly as hot as the steam could make it. Whether he clothed the cylinder as Mr. Watt does, is uncertain; but his model succeeded so well, as to induce some of the Cornish adventurers to send their engineers to examine it; and their report was so favourable as to induce an intention of adopting it. This, however, was soon after Mr. Watt had his Act of Parliament passed for the extension of his term; and he had about the same time made proposals to the Cornish gentlemen to send his engine into that county. This necessarily brought on a competition, in which Mr. Watt succeeded: but it was asserted by Mr. Gainsborough, that the mode of condensing out of the cylinder was communicated to Mr. Watt by the officious folly of an acquaintance, who was fully informed of what Mr. Gainsborough had in hand. This circumstance, as here related, receives some confirmation by a declaration of Mr. Gainsborough, the painter, to Mr. T. More, late secretary to the Society for the Encouragement of the Arts, who gave the writer of this article the information; and it is well known that Mr. Gainsborough opposed the petition to the House of Commons, through the interest of General Conway.' *Hornblower* in *Gregory's Mech.* p. 362, vol. ii. 1st edition. On this extraordinary and disingenuous statement Dr. Brewster gives the following comment:—'We believe and hope, for the sake of the memory of a very respectable man, that the conversation is not accurately represented. It remains upon record, that Mr. T. More was examined as a witness on the trial of the cause Bolton *versus* Bull, in 1792, at which time Mr. Hornblower himself was also examined as a witness, but on the opposite side from Mr. More. Mr. More on this occasion was asked, 'whether he had read the specification of Mr. Watt's invention, and whether in his opinion it contained a disclosure of the principles of the Steam-Engine?' To this question he answered, 'I am fully of opinion that it contains the principles, entirely, clearly, and demonstratively.' He was then asked, 'Did you ever meet with the application of these principles before you knew of Mr. Watt's Engine?' His answer was, 'I do declare I never saw the principles laid down in Mr. Watt's specification, either applied to the Steam-Engine previous to his taking it up, or ever read of any such thing whatever.' It is not easy to reconcile these two answers given by that gentleman upon oath, with the words that Mr. Hornblower has put into his mouth, p. 328. Mr. Gainsborough's idea, whatever it was, was posterior by more than twenty years.'—*Edinburgh Review*, 1809.

"Dr. Robison, in describing this improvement of the condenser, speaks of it as if applied to Newcomen's Engine. This, however, does not appear ever to have been contemplated by Mr. Watt: in a note he says, 'From the first I proposed to act upon the piston with steam instead of the atmosphere, and my model was so constructed.'"

the bottom, and a second pipe to convey the steam from the upper end of the cylinder to the vessel in which the steam was to be condensed. To save apparatus the cylinder was inverted. A hole was drilled longitudinally through the axis of the stem of the piston, and a valve was fixed at its lower end, to permit the water produced by the steam which was condensed at first entering the cylinder to escape. The *condenser* was made of two pipes of tin plate, ten or twelve inches long, and about a sixth of an inch in diameter, placed perpendicularly, and communicating at top with a short horizontal pipe of large diameter, shut at its upper end, with a valve opening upwards. These pipes were joined at bottom to another perpendicular pipe about an inch in diameter, which served for the air and water-pump. These pipes and pump were all placed in a cistern filled with cold water.

"The steam-pipe was attached to a small boiler. When steam was generated, it filled the cylinder, and soon issued at the longitudinal perforation of the rod, and through the valve into the condenser: when it was judged the air was expelled, the steam-cock was shut and the air-pump piston-rod was drawn up, which, leaving a vacuum in the condenser pipes, the steam entered them, and was condensed: the piston of the cylinder immediately rose and lifted a weight of about eighteen pounds, which was hung to the lower end of the piston-rod. The exhaustion-cock was shut, the steam was re-admitted into the cylinder, and the operation was repeated; and excepting the non-application of the steam-case, and external covering to prevent the dissipation of the heat by radiation, the invention was complete as far as regarded the savings of steam and fuel. To verify the expectations that Mr. Watt had formed of the advantages of his invention, he constructed a large model with an outer cylinder and wooden case, the effect of which exceeded his most sanguine expectations.

"This form of the condenser was afterwards changed; it being found that to condense the steam used in a large engine by the cold water being applied on the outside of the condenser, would require vessels of large and very inconvenient dimension. And it was also found that, from the nature of the water with which the engines are frequently supplied, a stony crust was quickly formed upon the outside of the iron-plate of the condenser, which greatly diminished, or altogether destroyed its conducting power."

These various improvements were combined in a very masterly manner, in what are called "Watt's Single Reciprocating Engines;" Mr. Stuart's drawing of which, is prefixed to our present notice.

"The pipe *d* conducts steam from a boiler (which is omitted in order to have the principal parts of the apparatus on a larger scale); *e* is the nozle, or square box, containing a valve, which in its rise or fall opens or shuts the passage between one side of the piston and the boiler, and also between the pipe *o l*, and the cylinder *a*. Y Y is the interstice between the casing and its cylinder: the casing was called the *jacket*. This interval was sometimes filled with charcoal, or some other slow conducting substance; or steam from the boiler might be admitted into it: by any of these means the radiation of heat from the steam cylinder, and its conduction by the air, was very perfectly prevented. *b* is the steam piston attached to the lever-beam by the rod *s*. The pins or tappets *n n*, fixed on the *plug-frame* (or tappet rod), which in our figure also serves for the rod of the pump, attached to the condensing apparatus: at the ascent or descent of these pins, they strike on the ends of the levers or spanners *m m m*, connected with the valves *e f c*, and open or shut them, as they may be adjusted. The condenser *h*, is connected with the steam cylinder by the pipes *u* and *g*. The air-pump barrel is attached to this vessel by the pipe *s*, which is furnished with a valve opening from the condenser: the piston is similar to those usually employed in water-pumps, with the exception of the joints of the valves being made of metal instead of leather; the condensing pump *i*, has a short pipe proceeding from near its top, on the end of which is a valve *k*, opening outwards, and into a vessel of water *r*: the condenser and its pump are placed in a cistern of water, kept as cold as possible, by allowing the heated water to escape, and renewing the supply from the mine or some reservoir by a pump *q*, which is worked by a rod attached to the lever-beam. The short pipe *k*, opens into a cistern generally separated from that in which the condenser is placed, in the manner shown in the figure. From this cistern water is pumped into the boiler through the pipe *p*, by the pump *A*, to supply its waste from evaporation.

a foundation of masonry or wood, on which the cylinder is fixed; o, a post or beam to receive the spanner fulcrum—in some engines it is supplied by brackets fixed to the cylinder; w is a *stuffing-box*, first used by Mr. Watt, to keep the aperture in which the piston-rod slides steam-tight; the rod of the mine pump is suspended at the opposite end of the lever to the steam piston-rod, as in the figures of the Atmospheric Engine (the limits of our page not permitting a greater extension, it is not shown in the engraving). This end of the lever, or the rods attached to it, are made so much heavier than those on the other side of the axis, as to be sufficient to act as a counterpoise to raise the steam-piston from the bottom to the top of the cylinder. The steam-cylinder is closed at top, and the rod slides through the stuffing-box; so that all communication with the atmosphere, and any part either of the cylinder or the condenser, is completely prevented.

"If we now suppose the apparatus to be in the position shown in the figure, and a proper supply of steam in the boiler, the valves *c e f* are to be opened, and *n* is shut. Steam then enters above and below the piston into the pipe *o* and the condenser *h*; when the cylinder becomes sufficiently heated, the steam will descend into the condenser, and from its less gravity occupying the upper portion, will expel all the air through the blowing valve *f*, which may have collected in those vessels, or which may have been produced by the condensation of the steam in heating the apparatus. The cock *e* is now to be shut, and the injection-cock opened; the jet of cold water will condense the steam in the condensor, and the steam under the piston in the cylinder *a*, rushing through the pipe *u g* to restore the equilibrium, will also be condensed by the jet which is kept playing; and a vacuum is formed in the cylinder and condenser. This condensation in the largest engines is prodigiously rapid; in practice it may be considered quite instantaneous. The communication between the boiler and the upper side of the piston remaining open, the elasticity of the vapour having now no resistance from that on the other side, presses the piston downwards into the vacuous space, until it reaches the bottom of the cylinder. At this instant the descent of the tappets in the plug-frame strikes the end of the spanners *m m*, connected with the valves *c f*, which depresses them, and prevents the further flow of steam from the boiler, and also shuts off the communication between the condenser and the cylinder.

"The piston of the condensing-pump, being attached to the same side of the axis with the cylinder, is also at the bottom of the barrel, and all the water and air which it contained having lifted up the valves which only rise upwards, is now above its piston,—the valve *s*, opening from the condenser, preventing its return into that vessel.

"It now becomes necessary to raise the steam-piston to the top of the cylinder.

"The mine-pump end of the lever-beam, and its rods, have been stated to be made heavier than those of the steam piston and condensing pump, in order to act as a counterpoise to raise the steam piston.

"But before this counterpoise can be brought to act, all the steam and air which has just depressed the piston, and still remains above it, must be got rid of. Mr. Watt accomplished this desideratum by a contrivance so simple, and yet so refined, as almost to equal in ingenuity the application of the condenser itself. He connected the top and bottom of the cylinder by a pipe, in which he placed a valve *e*: when, therefore, the valves *c* and *f* were closed, this valve was opened; the steam which was above the piston was now admitted under it, and the counterpoise raised the piston in a non-resisting medium.

"The opening of this valve *e*, is but a momentary operation, and the rise of the piston is not perceptibly of longer duration than its descent. When the counterpoise has raised it to the assigned height, a tappet acts on the end of the spanner connected with the valve *e*, and closes it, while at the same moment other tappets act on their levers to open again the cocks *c* and *f*, which are attached to them.

"The steam which had flowed through *o* and *e*, from the top of the cylinder to the space under the piston, now rushes through *u* and *g* (as at the first descent of the piston), and a vacuum is instantaneously formed in the cylinder, which allows the expansive force of the steam to press the piston downwards, until it has reached a second time the limit of its stroke. The tappets and spanners now close *c* and *f*, and open *e*, when the counterpoise again operates to draw up the piston.—The counterpoise has been stated as being made equal to raising the steam piston, but in fact it must also, in this arrangement of the parts, elevate the water and the condenser pump.

"The operation of the condenser pump is very simple. The water which spouts into the condenser through the injection-cock N, increased by the very small quantity arising from condensation, falls to the bottom of the condenser *h*. The upward motion of the pump-rod forming a vacuum in *i*, opens the valve *s*, which allows the water to flow through it from *h*: the water lying on the top of the piston being expelled through *k* into the cistern. The descent of the piston pressing on the water at the bottom of the barrel, which is prevented from returning by its opening inwards, the water and air raise the valves, which falling at the moment of the ascent of the piston, raise whatever water and air is above them until they are expelled at *k*. The hot water from this pump is generally again introduced into the boiler."

(*To be concluded in our next*).

FRENCH POLISH.

Gentlemen;—In Vol. II., p. 272, of the Mechanic's Magazine, I find an article respecting polish for furniture; but I do not understand by it, whether the tables are to be washed with cold water immediately after the first preparation of linseed oil and turpentine, or whether it is to be done on the following morning, before the mixture is applied again. As your correspondent "Josias Murray" kindly offers any farther information on the subject, if, through the medium of your valuable Magazine, he will state at what period the washing the table is to be performed, he will oblige

A Constant Reader.

CANAL NAVIGATION.

7, Basinghall-street,
Aug. 20, 1824.

Gentlemen;—I take leave to inform your correspondent "R. J. M." that if he will look at the Repertory for September 1822, p. 202, he will find, that in describing my patent improvements for steam-boats and floating breakwaters, I have recommended placing the paddle-wheels at the stern of the canal-boats, and I humbly think in the best manner that has been previously proposed; but the idea of placing the paddle-wheels at the stern, is as old as Mr. Hull's patent in the year 1736, an account of which he will find in the Edinburgh Philosophical Journal, Vol. IX. p. 276.

I am, Gentlemen,
Your most obedient servant,
David Gordon.

TO PREVENT BEER AND CIDER FROM SOURING.

Malt liquors and cider may be prevented from becoming sour, by adding about 4 lbs. of toasted bread to each hogshead. This I have tried more than once with complete success. *A Bit of a Mechanic*.

DEVONSHIRE COLIC—HOW TO MAKE GOOD CIDER.

At p. 224, Vol. I, the disease called the Devonshire colic, which is particularly prevalent during the summer months, is ascribed to the custom of making cider in leaden vats. The following communication from a correspondent traces it to a farther cause, and gives some useful directions for making good cider:—

The Devonshire colic is occasioned by another cause in making cider, and that is, the not racking it off from dregs, which rise to the top of each cask at about four days' fermentation, after which they settle to the bottom of the cask, and continue to fret the cider till it becomes completely sour. The disease is common in parts of Devonshire where the cider is never put into leaden vats at all, and where nothing but stone and wood are used. *To make cider properly*, it should be racked off at least twice; the first time into steamed casks, at the moment it is supposed all the dregs are at the top: the effect of steaming the casks (with sulphur) is to stop all farther fermentation: the second time it should be drawn off from the dregs, which will have subsided in about eight or nine days, into other steamed casks, when it will be perfectly wholesome, and will not fret or assume the acetous fermentation in the height of summer, which the dregs, when allowed to remain in the cider, promote. If at the end of one month it be racked off a third time, it will be still more pure.

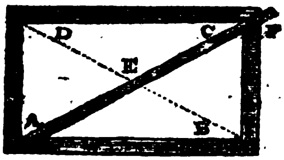
John Cowen.

MECHANICAL GEOMETRY.

(Continued from p. 332).

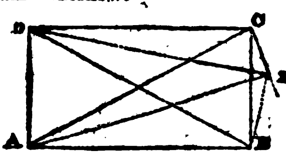
Problem 7.

To try whether any frame is square by means of measuring the diagonals.



Let A B C D be any frame, of which it is required to know whether all the sides are square to each other.

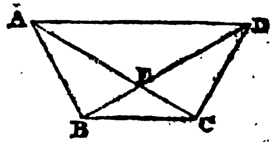
Take a lath of a sufficient length, as A E C F, and having bevelled one end off as at A, so that it will touch the angular point, measure the diagonal A C, and make a mark at C; now divide the distance A C into two equal parts at E; also take another lath, and measure the distance B D, and divide B D also into two equal parts. Now if the middle of the two laths correspond as at E, we may rest assured the frame is correctly square, and that its two opposite sides are equal to each other; for unless the two laths in crossing each other have the centre E of each corresponding, the work is not true, though the distance A C and B D may be equal, as the following diagram will show.



Let A B C D be a parallelogram, whose diagonals are therefore equal to each other; it is plain that the diagonal may be moved about the angular point A, from C to E; for instance, join E B and E D. The quadrangle A B E D has now both its diagonals equal, and the angle at A a right one, yet still its other angles are none of them right angles; and the same may be said if the diagonal B D is moved about the angle at B; the figure will then have none of its angles right ones; it may be also remarked, that if C E is ever so small, the centre of the diagonals will not correspond. Thus it is evident that the diagonals of a quadrangle may be equal to each other, and yet the figure may not be a rectangle. The practical workman will here observe, that the smallest deviation in the length of the opposite sides A B and C D, or A B and B C, will prevent the frame being perfectly square, and thus by this method any errors may be detected in the length of the sides, which is, in many cases, of material consequence, as in window-frames, drawers, &c. which will never run true unless great care be taken to ascertain their accuracy.

Problem 8.

From any given point to make an angle equal to any other given angle.



Let C be a given point in the line B C, from which it is required to draw C D, to make an angle with B C, equal to the given angle A B C, made by the lines A B and B C.

Join A C, and draw A D parallel to B C; then from B make B D equal in length to A C, and join D C; then is the angle D C B equal to the angle A B C, as was required.

Note.—We may here observe, that though the diagonals are equal, the quadrangle has only two of its sides parallel: in this case the intersection of the diagonals approaches nigher to B C than to A D, and A E or E D is greater than B E or C E, and also E B is equal E C, and E A is equal E D.

The practical utility of this problem I need scarcely point out; for it will be evident to any workman, that if he have a bow window, for instance, to set out, whose opening shall be equal to A D, we need only draw a parallel, as D C, at the distance it is required to project; then from A and D measure equal distances to B C, either larger or shorter, as B C is required, and we are sure that the faces A D and D C are equal and properly set out: also to chair and cabinet makers this problem will present much useful application.

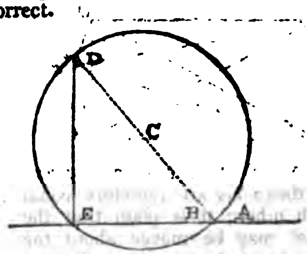
I shall here close the *first part* of these essays on Mechanical Geometry. To the geometrician they may seem but a slender specimen of mathematical knowledge; yet the parties to whom it is addressed will, I am sure, give some credit for the endeavours to simplify a science which is so completely blended with mechanical pursuits, that the practical mechanic is working, as it were, in the dark without its assistance. And here I must observe, that what has hitherto been advanced, treats only as far as regards right or straight lines. It will be my endeavour, in the *second part*, to show the chief of Euclid's propositions, as regards the circle and its several parts, and in this manner to bring the practical mechanic acquainted by degrees with that science, which will, above all others, assist him in his endeavours to excel in that branch of trade which is allotted him as his means of adding to the conveniences and necessaries of his fellow men.

G. A. S.

FORMING THE SQUARE AND ELLIPSIS.

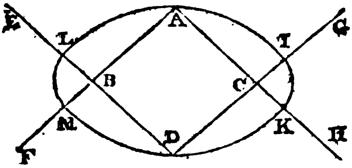
Holland-street, Blackfriars-road.

GENTLEMEN;—From the readiness with which you insert in your valuable Magazine such papers as are likely to contribute, in any degree, to the advancement of science, or the improvement of mankind, I am induced to add a few observations to those of your correspondent "G. A. S.," to whom, no doubt, those carpenters and others who are unacquainted with the principles of geometry, will feel themselves particularly indebted for the very clear directions he has given to ascertain the accuracy of such implements as their respective trades render indispensable: nevertheless, it appears to me, that of two methods to find the correctness of the *square*, the better one has escaped his observation. Another figure, a knowledge to describe which, is essentially necessary to those for whom his treatise is intended, ought not, I conceive, to have been omitted,—I allude to the formation of an *ellipsis with compasses*, which, though by no means new, is certainly confined to the knowledge of but comparatively few individuals. My remarks will not, therefore, I trust, be considered either superfluous or obtrusive. Indeed I have been led to this communication from the inconvenience which I formerly experienced through a defect of similar information. I shall now proceed to an explanation of the two figures above mentioned, in doing which, for the more easy comprehension of the mechanic, I will divest the subject of geometrical technicalities, and give my description in the plainest manner possible. To form the square, first draw a straight line, as A, to any length, upon which describe a circle, larger or smaller, according to the intended size of the square: then draw an oblique line from the intersected point B to D, taking care that it pass through the radius C; now draw a perpendicular line from E to D: then will B E D describe a perfect square. Now, to try the correctness of the tool so denominated, it is only requisite to place it on the one described; and if it do not in every way correspond, it must, of course, be incorrect.



An ellipsis may be described with compasses in the following simple manner: Form a quadrangle, as A B C D, beyond which extend the lines E F G H. Take your radius at D, and draw the curve L I; take your radius again at A, and draw the curve M K; now let your radii be

B and C, to form the curves L K and M L, when the ellipsis will be perfectly described.



However trifling this communication may appear to some individuals, I trust, Gentlemen, you will consider it of sufficient importance to give it a corner in your valuable miscellany, by which you will not only insure the thanks of a considerable portion of a very useful body of mechanics, but confer an obligation on, Gentlemen,

Your very obedient servant,

Massa Jonas.

[Having communicated the preceding paper to G. A. S., he has favoured us with the following observations upon it.—Edit.]

Massa Jonas appears to me in rather too great a hurry; for if he look with attention to what has yet appeared, he will find that I have not at present entered at all into the properties of the *circle*, as I studiously avoided it, and for this reason, that, as knowledge is gained step by step, the working mechanic, in my humble opinion, ought to be well acquainted with the nature and properties of *straight lines* in the first instance, and of the problems that can be performed with their assistance *alone*, before he enter upon circles, or other figures that are more complicated, though, at the same time, more fruitful in their application. He would, if he had waited, have seen something like what he has communicated, when I should have entered into that part where the properties of the circle are to be considered; for though his method is strictly correct, yet we are not to suppose every mechanic acquainted with that property of the circle which shows that lines drawn from the extremities of a diameter, and meeting in the circumference, is a right angle. With respect to the latter part of his communication, though I cannot agree with him that the ellipsis is *perfectly* described, I will allow that the method pointed out may, in some cases, be useful to the mechanic. It is faulty, however, in not teaching us how to draw the figure whose conjugate and transverse diameters shall be given lines. I shall hereafter point out a method of performing this equally simple with that of M. J., and, as I conceive, more accurate.

G. A. S.

June 29, 1824.

ELGIN MARBLES.

Gentlemen;—Having been lately in the British Museum, I observed at the entrance a number of columns, chiefly (I believe) of granite, which I had years before observed in the same situation. They are now, in the true sense of the term, dilapidating, which, I am of opinion, would not have been the case, at least to so great an extent, had they been placed in an upright position on their arrival, with perhaps a slight roof or covering over them; for it is a well-known property of all stone to exfoliate when placed in any position, except that in which it was taken from the quarry, or, as a quarry-man would say, "on its bed."

Query.—Could not these least affected be used in conspicuous situations in the intended buildings for the King's books? At all events, I hope that this, or a hint from any other, to the same purport, may prevent any fresh importation from sharing a similar fate.

J. B. B.

LONDON MECHANICS' INSTITUTION.

August 2, 1824.

Gentlemen;—As your pages are always open to calm and candid discussion, I shall not offer any apology for the remarks I am going to make, and merely state, that I wish them to be given to my brother mechanics, as the paragraph of which I complain seems also with them to have created a feeling of irritation. The passage to which I allude, occurs in No. 49, where, in speaking of the Glasgow Institution, and comparing it with ours, you say, "Though its managers have *paid nothing* to any of the lecturers hitherto employed (rather forgetful, it would seem, of those principles of independence on which the Institution originally professed to proceed)," &c. &c. &c. Although the extract from Dr. B.'s letter certainly seems to bear upon the point, I do not conceive he could have intended by such words, or any he could utter, that the mechanics were to refuse the lectures which might be offered to them gratuitously. Would it not have been rude of us to say to those gentlemen who so kindly offered their assistance by lectures, "No; we are determined to act upon principles so strictly independent, that we must reject your kind offers; at the same time we shall be glad to hear you, provided you will be paid for it"? Do you think, after such ungrateful conduct, Professor Millington, Dr. Birkbeck, or Mr. Phillips, would have favoured us with their valuable time? Certainly not. At the same time (and I am proud to say it), we did not *ask* them to lecture us gratis. It is an honour conferred upon us to have their offers. Dr. B. says, "that it should be unaccompanied by any feelings of dependence." Very good, and this bears *me* out; for you really cannot think that we should feel dependent upon them because they *offered* their services. We ought certainly to be jealous of our independence, and watch over it with the most scrupulous eye; yet I think it is betraying a weakness to cry out before there is occasion, and particularly so on such weak grounds.

J. M. B.

[We are not surprised, nor at all sorry, to learn that the remarks which have produced the preceding communication, have touched the *feelings* of the London mechanics. It shows, what we never doubted was the case, that *they* feel correctly enough on the subject; and that, *had it depended on them*, we should never have had occasion to make a comparison so unfavourable to their sense of independence as we have done.

The view of the matter taken by our correspondent is one which, we regret to say, has been too long in vogue with the upper classes of society. It would seem as if among certain titled and wealthy persons it were thought a *disgrace* to derive emolument from any employment of their time and talents, which has the interests of the lower orders for its object; they will not condescend (although we would have them) to accept of pecuniary remuneration; we must receive their services gratuitously, or want them altogether. Why such a feeling should prevail among the higher ranks we are at a loss to perceive. Is it because the objects of their good-will are poor? Then, according to that principle, they ought not to send their corn and cattle to market, because poor folks may happen to buy them. "But that," we shall be told, "is quite a different thing; to give our corn and cattle to the poor for nothing, would deprive men of every motive to industry, and undermine the very prosperity they feed upon." True, it would, and it is exactly for a similar reason that we would have you bring your talents as you bring your beeves to market. Plenty of food without labour, is not more certain of begetting idleness, and idleness vice, and vice ruin, than valuable services, without cost, are certain of producing a spirit of dependence, and dependence carelessness, and carelessness beggary. The ways are different—the one, perhaps, a little longer and more devious than the other; but the end of both is the same.

The doer of a good service may be rich—he may be noble; but what does it matter that he is either? A patent of nobility is not a patent to treat independent poverty like crouching beggary; nor can all the riches of a rich man render his services in the smallest degree less worthy of requital than they intrinsically are.

Would we, then, it may be asked, exclude utterly rich and benevolent individuals from doing good gratuitously; from educating and instructing, for example, the lower classes? We do not just say that; if we met with a man of infinite knowledge, who had nevertheless so erroneous a notion of things, that he would only impart his knowledge on the condition that he should receive nothing for it, we should probably yield to his whim; but what we say, and will ever contend for, is, that the way by which the rich and benevolent may best do good to the lower classes, is to accept such payment as they are able to give them for their services. Humble as the circumstances of an individual may be, yet, if he is at all able, by the labour of his hands, and by a provident management of its fruits, to obtain instruction as well as food and clothing for himself and his children, he becomes nothing else than an object of *charity*, when he accepts for nothing, services which he ought to pay for according to his ability. All gratuitous instruction serves to weaken and impair the sense of independence which it is of so much importance to cherish in the working classes; and no intelligent person who has their welfare sincerely at heart should think of imposing it upon them.

For persons whom no reflection can cure of their squeamishness about taking money from working people, there are ways by which they may, notwithstanding, easily settle the matter with their consciences. They may employ the money they receive *in doing more good;* in educating, for example, those who *are* paupers, and whom it disgraceth not, to receive whatever the hand of humanity has to bestow upon them.

The payment of money, however little, for any stipulated service, has other beneficial effects, of too great importance to be overlooked. Money is never paid but it begets necessarily the consideration what it is paid for; nor can it ever be received by a person of a conscientious mind as a reward for services agreed to be performed, without leading him to consider well how he has performed them. When people do things for nothing, they are but too apt to grow careless about the manner of doing them, and expect, at least, that they shall be very easily dealt with for any sins of omission into which they may happen to fall. Nor would it be fair to deal with them otherwise; for there is sense in the old proverb, that we should not "look a gift-horse in the mouth."

When things, too, are got for nothing, they are naturally less prized than when they must be paid for by some portion of the fruits of our industry. To give instruction gratuitously is the very way therefore to make it unheeded and useless.

We must, in conclusion, again bring to the recollection of our readers how distinctly and solemnly the principles for which we contend were *consecrated* in the establishment of the London Mechanics' Institution. In our invitation to the public [see p. 20, Vol. I.] were these words:—

"We do not propose that they (the mechanics) shall be indebted to the contributions of benevolent individuals for the sums of money necessary to have rooms and teachers: *they must not depend on charity, but on themselves; they must pay for instruction.* We believe, however, they may be obtained at a very cheap rate, if the mechanics will take the matter into their own hands. They may be assured that unless they do that, unless they make such an Institution their own and for them, they will never feel that zeal for it, that kindliness towards it, which men have for things which *belong to themselves.*"

The first gentleman who came forward to aid us in the establishment of the Institution, was Dr. Birkbeck; and how completely he concurred in the sentiments just quoted, our readers have seen from the extract from his letter to us, given in a former Number.

Mr. Brougham also, another of the earliest patrons of the Institution, took precisely the same view of the matter. In a letter from him to Dr. Birkbeck, published at length, p. 180, Vol. I. he says, "I look upon the successful prosecution of that object as nearly certain, because the principle on which we proceed is undeniably sound: that the body *of the people should take upon themselves* the care of their own instruction, *after having had the means put within their reach*, whenever they are in want of them."

We have still another authority to bring forward of more weight even than any we have yet quoted. It is that of the Public Meeting which first gave being to the Institution, in the resolutions of which the "principle of self-support and exertion" was proclaimed to the world, as that to which alone the mechanics and their friends looked for the lasting prosperity of that and every association of the working classes for the acquisition of knowledge.

How far the managers of the Institution have adhered to that principle, in having hitherto had nothing but gratuitous lectures, it is unnecessary to say.—EDIT.]

ANSWERS TO INQUIRIES.

No. 43.—THE CASE IN MACHINERY.

I feel little interest in pursuing a subject, the facts of which have been so long and so incontrovertibly established; but as "Eproth," I fear, has not made any great progress in his mechanical studies (otherwise he could not have expected such a result), I will endeavour to put him in the way of satisfying his mind as to the fallacy of his notion.

The word *notion* he has very properly used; because, had he proceeded to dissect and investigate his plan minutely and scientifically to obtain its theory, he could not fail to have discovered his error. I would here remark, that the term *theory* is very generally applied to every *notion*, however false or absurd; but I conceive it ought only to be used to designate any matured plan that has been reduced to a certainty so far as the acuteness and sagacity of genius, aided by science, is capable of, previous to a practical proof.

But to the subject. The general rule quoted, namely, "that what is gained in power is lost in time," is one of those laws that cannot, like human laws, be made to deviate, or become subservient to gratify the capricious wishes and desires of man; for however it may be mystified and covered by complexity, it will be found, on investigation, still to be operating with its beautiful simplicity. The question of "Eproth" appears to be, simply this—that, suppose a piston at the top of a cylinder were to have the air withdrawn from beneath, by the action of a pump, whether such piston would not descend as the air is exhausted, with a force equal to the weight of the atmosphere on its whole area? Impossible! which will be readily seen. It must be kept in mind that air is *elastic*, and that by withdrawing any portion, suppose 1,000 parts, it is evident that 999 are left acting expansively under the piston; and hence if the piston-rod be attached to one end of a lever, and a weight equal 1,000 parts of the pressure of the atmosphere on the area of the piston, be applied to the other, it would be sufficient to counteract the loss of air in the cylinder, and keep the piston in its original position; but when a second stroke is made by the pump, the piston would sink, and rise the weight at the other extremity of the beam to an extent equal only to the proportion that the capacity of the pump bears to the contents of the cylinder. A continued repetition of this operation would ultimately bring the piston to the bottom; but its power of lifting would not be increased, though its motion would be more rapid in proportion as the contents of the pump and the cylinder under the piston become more nearly assimilated. The only way by which the whole weight of the atmosphere could be obtained would be to support the piston, and make a perfect vacuum beneath; then on the piston being released, it would descend with a force equal to the weight of the atmosphere on its area; still, however, all the power so acquired would not be equal to that which was expended in working the pump on account of friction, &c.; the disadvantages, too, of procuring a vacuum by means of an *elastic* fluid is very great, inasmuch as the power absolutely necessary to work the pump is continually *varying* at every stroke until the vacuum is effected. In order to render calculation more simple and easy, we will suppose the cylinder to be filled with water instead of air, the expense of extracting which would be less than that of an expansive fluid, even if the apparatus were made in the most perfect manner, and the power employed carefully and continually adjusted with the utmost nicety of proportion to the diminishing elasticity within the cylinder, on account of the greater number of strokes necessary to free a vessel of an elastic, than those requisite for a non-elastic fluid.

In extracting water from a cylinder, then, the effect would be somewhat different, as the piston would follow and be capable of lifting a load equal in weight to nearly 15 lbs. per inch on every square inch of its area, on account of the non-elasticity of the water, and its incapacity to act against the under side of the piston, whenever so small a portion is withdrawn. Therefore, to calculate the power necessary to extract the water from the cylinder, we must first ascertain its contents, and divide this by the quantity that the pump is capable of discharging per stroke, and we shall have the number of strokes necessary to perform the operation; then multiply 15 lbs. by the area of the pump piston in inches, and that product again by the length of the stroke, and we have the sum of the power sought. If we then multiply the pressure of the atmosphere on the area of the piston by the number of inches through which it moves in its descent, it will give the whole force that can possibly be generated, and which will be found equal only to that expended in obtaining it, leaving, as I stated on a former occasion, minus friction, &c.

Thus, then, we cannot possibly, by forcing, compressing, or exhausting, obtain a profit of power, either from an elastic or non-elastic fluid. Could we do so, the golden dreams of the perpetual-motionists, of which this is but another version, would be realized. It often happens, however, that such means are resorted to, to produce most important results, which could not otherwise be conveniently accomplished, and in all probability, in some instances could not be accomplished at all. One such application we may notice in the hydraulic press, invented by the late ingenious Bramah, which is governed by the same law, and in effect may be regarded as a combination of wheels and pinions, in a more convenient form, of almost unbounded strength, and capable of being employed when the application of the latter would be quite useless both as to strength and convenience. G.

No. 54.—BORING FOR WATER.

Gentlemen;—A correspondent asks (p. 352), "if the system of boring for water will answer in the neighbourhood of chalk hills?"

The chalk deposit extends in one direction, from Flamborough Head, in Yorkshire, to Dorchester; and in another, from Marlboro' to Lewes and Dover. This rock being so extensive, and its character so various in its different localities, renders it very difficult to give a general answer to the question. If the stratum be compact and solid, there is little chance of finding springs, except at great depths. Near Ruthby, in Lincolnshire, there is a well in the chalk, 300 feet deep; in Bedfordshire, 400 feet; near Sittingbourne, in Kent, 363 feet; in Surrey, near Dorking, 440 feet; in Hampshire, near Selbourne, 300 feet. At Dover Castle the well is 400 feet deep, and the water in it stands at an inconsiderable height. In Hertfordshire the same depth has been penetrated without finding any water; and at Stamford Hill the chalk was bored 100 feet, with the same result. But in situations where the bed is not so thick, or near the base of chalk hills, water is often found at a moderate depth; for this rock being very porous, all the rain which falls upon it, percolates downwards, till it is stopped by the usual substratum of clay, and hence the lower beds of chalk, and every fissure in them, are generally full of water.

I am, Gentlemen,

Your obedient servant,

Geologos.

No. 44.—TEMPERING IRON.

Gentlemen;—When scrap-iron is sunk in the finery, some portions of it are very liable to become steel by uniting with the carbon of the charcoal employed; and to this circumstance the occurrence of "hard places" in the bar-iron manufactured by your correspondent (Vol. II. p. 318) Z. Y. is, no doubt, to be attributed.

This defect he may remedy by cementing the bars with his own *haum slick* reduced to powder, and continuing the heat for a longer or shorter period, according to the strength of the bars: in general, five or six days will not be too long. During the cementation, the bars must be carefully defended from the air.

As Z. Y. mentions "fluting" his iron, I am led to suppose, that it is applied to the making of cotton-mill rollers, or some article of no great length; if so, I would suggest the cutting the bars into the length required, and cementing these pieces instead of whole bars.

If the cementing process above recommended be carefully performed, every part of the iron operated upon will be found to be unusually soft and *leady* throughout.

At an iron-work, in which I was concerned, we occasionally sunk in a charcoal finery the scraps or parings of COND iron, produced at a plating-forge in the neighbourhood; and, notwithstanding the superior quality of this iron, the bars made from it by the finery were, in many instances, so completely red-short, as to drop asunder while the finer was drawing an ancony from the half-bloom or billet.

I would further suggest to Z. Y. the eligibility of rolling his billets from the puddling-furnace, instead of employing the finery and forge-hammer, or at least of substituting the balling furnace for the finery; as by this means he would produce an iron free from the defect he wishes to avoid. I have seen this method practised at Birmingham and other places, and I understand it is much in use for the working of light scraps.

I am, Gentlemen,
Your obedient servant,
T. L.

INQUIRIES.

No. 58.—PLAN FOR A COTTAGE WANTED.

Being about to erect a cottage at the corner of a garden next a public road for the residence of the gardener, and wishing to have it a little ornamented as well as useful, I shall feel obliged to any of your correspondents that will favour me with a plan and elevation for such a building. I purpose to build it of brick and flint, that is, brick quoins, and flint for the middle work; and that it should consist of a family room, with cellar, under, about 12 feet square; a kitchen or better sort of washhouse behind, not quite so large; and one chamber over the family room, and a smaller one in the lean-to roof of the kitchen.

The entrance may be at the side, so as to afford a passage and staircase, if thought desirable. The style gothic.

As an encouragement to young draftsmen, I will present the author of the plan I make choice of, with two guineas.

X. X.

[We shall be happy to give place to a drawing of the most approved plan.—Edit.]

No. 59.—WELL-BORING ON DENMARK HILL.

Gentlemen;—Any of your intelligent readers would confer a favour, could they inform me, if boring for water on the top of Denmark Hill, Camberwell, would be attended with success. It is necessary to dig to the depth of one hundred and fifty feet to get at good water; this is attended with such great expence, that few persons who rent houses on the Hill are inclined to dig wells if they can help it. I might also be able to learn what the expence would be of boring to the necessary depth on that spot.

H. O.

No. 60.—HAND CORN-MILL.

Gentlemen;—You will oblige a constant reader by requesting, through the medium of your highly useful Magazine, some of your mechanical friends to give a plan and description of a portable hand mill for grinding Indian corn, wheat, &c. as I am about to emigrate to our colony of New South Wales, where I shall be forced to become my own miller. The mill must be simple in its construction, and take up little room. If such mills are already made for sale, will some one of your correspondents have the goodness to point out where they are made?

NEW PROPELLING MACHINERY.

An ingenious mechanic, of the name of Hoxie, is now exhibiting, at New York, a model of machinery, by which he is confident vessels of any size may be propelled at sea, independent of wind or steam, the motion of the vessel being alone required to give it effect. It is said that "the machinery is simple, and would take up but an inconsiderable space in a vessel; three or four feet in length and the breadth of the vessel would be amply sufficient for its operation. A rotatory motion is produced by a vibrating weight in the hold of the vessel, without the aid of a crank; an iron shaft connects the horizontal wheel in the hold (propelled by the pendulum) with another on deck, which latter causes the shaft, on which are the paddles, to turn; and thus is the machine put in operation. A portion of a cargo, such articles as are heavy, might be placed as weight in the pendulum, to the amount of some tons; and thus may this machinery be used without much diminution of the quantity of cargo dependent on sails and wind for propulsion."

NEW PATENTS.

To John Hobbins, of Walsall, Staffordshire, ironmonger; for improvements in gas apparatus.—22nd June.

To Humphrey Austin, of Alderley Mills, Gloucestershire, manufacturer; for certain improvements on shearing machines. —22nd June.

To John Benton Higgin, of Gravel Lane, Houndsditch, Middlesex, gentleman; for an improvement or addition to carving knives and other edged tools.—22nd June.

To William Busk, of Broad-street, London, merchant; for certain improvements in the means or method of propelling ships' boats or other floating bodies. —29th June.

To William Pontifex, the younger, of Shoe-lane, London, coppersmith and engineer; for improved modes of adjusting or equalizing the pressure of fluids or liquids in pipes or tubes, and also an improved mode of measuring the said fluids or liquids.—1st July.

To John Leigh Bradbury, of Manchester, Lancashire; for a mode of twisting, spinning, or throwing silk, cotton, wool, linen, or other threads, or fibrous substances.—3rd July.

TO CORRESPONDENTS.

Two able refutations by J. Y. and G. A. S. of the paper by Majertingun in our 50th Number, on Projectile and Gravitating Forces, have been received, and shall have an early place. In what *we* added to that article, we did but quote from Captain Kennan, not agree with him. The epithet "cleverly discussed" we are not inclined to recall; a man may be cleverly in the wrong.

Homo (near Grimsby). We shall endeavour to provide the medium he wants. In the mean time he will be so good as to consider himself exempted from the general rule.

Mr. Ellington's communication was overlooked in our acknowledgments, from its having immediately on receipt been sent to the draughtsman, to make a drawing of the illustrative figure. It is intended for insertion.

A. K.'s Tribute of Respect, though very *mechanical* poetry, is not *polished* enough for our *cabinet*.

R. O. N. M. has reason to complain; his inquiry was mislaid. It will appear in our next.

Answers to Inquiry 57 received from J. Y.—Secker—W. H. F——r.—J. R. Coombs—and P. Vanryde.

Tertium Quid is quite right in saying that it was absurd to call Mr. Brown's an "*Explosive* Engine," when the description that followed showed that no *explosion* was resorted to; but if he will look again at the manner in which the article on the subject was inserted in our last Number, he will perceive that the title was not *ours*, but quoted from a contemporary journal. Some farther particulars of this ingenious machine we hope to be able to give in our next.

The Index to Vol. II. will appear in a Supplement, to be published along with No. 57. With Vol. III. we shall commence printing with a new type and on a finer paper; in the engravings also there will be a considerable improvement.

Communications received from W. B. —X. Y.—Mechanicus—S. Boddington —A Constant Reader—Aurum—J. M. —J. G.—G. Francis—Mr. Marsh—Amateur—A Subscriber—Joseph Turner— An Old Mechanic—M. Place.

Communications (post paid) to be addressed to the Editors, at

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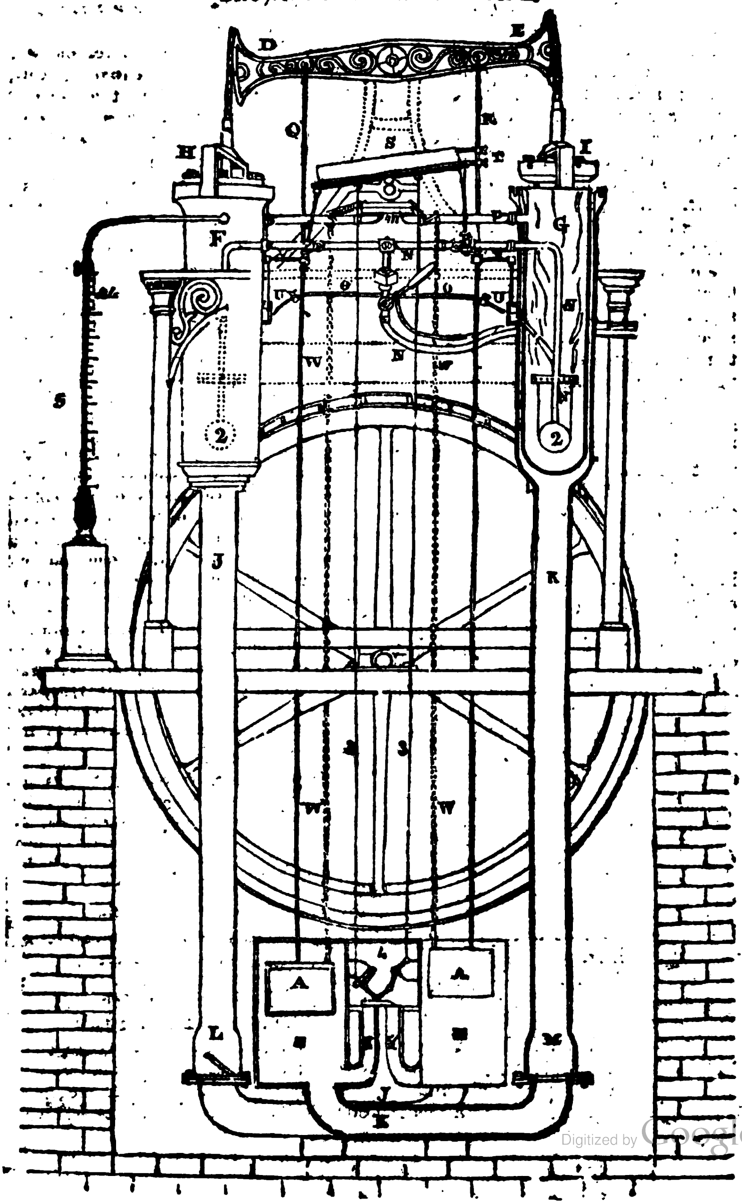
Museum, Register, Journal, & Gazette.

I, Wisdom, dwell with Prudence, and find out knowledge of witty inventions.
Proverbs of Solomon.

No. 53.] SATURDAY, AUGUST 28, 1824. [Price 3d.

BROWN'S PNEUMATIC ENGINE.



BROWN'S PNEUMATIC ENGINE.

The powers with which the combination of chemistry and mechanics have armed man, appear to be as inexhaustible as they are vast and important. Not many years have elapsed since we had no means of turning machinery upon land but the feeble strength of animals, the sluggish water, and the capricious wind; and no means of impelling a vessel across the ocean but the tide, the oar, and the sail. The first of these was not only expensive, but also difficult to be combined into any great effort. If a power of, say twenty horses be required, you must employ thirty, the sum not being equal to all the individuals; and if the action is to be constant, you must maintain at least sixty. So that the profits of this species of power diminish in proportion as the power is increased. The power of water again is local; you cannot have it where you would wish; and the place where the power is the best, is commonly the least convenient for its use, water-falls being most abundant in poor and mountainous districts. With regard to the wind again, it is so perfectly capricious, that you have no control over it. It comes when you need it not, and when you do need it, it is not to be obtained.

Steam is much more manageable; but still the expense of steam is considerable, from the waste of heat in the production of it by the very best constructed apparatus. If used, too, so as to produce its maximum of effect, it acts violently upon the containing vessels, and requires great strength to guard against accidents. Still the power of steam is one of the best, if not the very best, that has been hitherto used, and the application of it has, perhaps, been productive of more benefit to the arts than any of the others.

Atmospheric pressure is the most simple and universal of the natural powers; we have it in all countries, and in all situations: it is a willing servant too, for it acts wherever we can make room for it,—obtain but a vacuum little more than a foot square, and you have a power which will lift a ton.

We need not inform our readers that steam was first used as an auxiliary to atmospheric pressure; that before the splendid and scientific discoveries by Watt, steam was employed chiefly to procure a vacuum, into which the piston was forced by the weight of the atmosphere.

Since steam was made to act upon both sides of the piston, the use of atmospheric pressure, as a moving power, has in a great measure fallen into disuse, from the want of a cheaper and more convenient means of forming a vacuum than by steam, a substance now employed to better purpose. Attempts have, no doubt, been made by various persons, and with various substances; but, till this one by Mr. Brown, they have uniformly failed. In general, the plan has been to explode hydrogen gas in close vessels; but either the gas would not explode, or there was a blowing up of the apparatus.

Mr. Brown has tried gas for the production of a vacuum; and, by employing the *extinction of a peaceable flame*, instead of a *violent explosion*, he has succeeded—has furnished his country and the world with a power which, judging from the *first* machine, (and what would have been the judgment from the *first* steam-engine?) will be convenient in its application, and cheap and safe in its use beyond all precedent.

We have examined the engine very minutely, in company with the ingenious inventor, whose politeness is not less than his mechanical skill; and we hesitate not to say, that, to us—to any one who chooses to look at it, there is not the least doubt either of the soundness of the principle or the universality of the application. Before, however, we can make our readers fully understand the nature and merits of the invention, we must refer to the engraving, which we had drawn by an artist of the first eminence, and with the most perfect accuracy; and, lest there should have been any fault which neither we nor our draftsman could discover, we took the liberty of submitting the drawing to Mr. Brown previous to its being engraved; and we can also state that he expressed himself satisfied with its accuracy.

Description of the Plate.

The view which we have given represents the front of the model, which may be about 1½ horse's power. It is employed in raising water and turning an overshot wheel. In order to render the machinery better understood, we have supposed part of the frame-work to be cut away, and we have shown that part (the part below the water-wheel) which is concealed in a pit under the floor.

F and G are the two cylinders, in which alternately the vacuum is produced. F is represented shut and entire, and G open and in section. Those cylinders are open at top and closed at bottom, but have near the bottom eduction valves, which open outwards for the discharge of the water.

F and G are inclosed within two other cylinders, with a clear space between, which allows the water to ascend and flow over the tops into F and G, after the vacuum has been obtained. The water, in this situation, also keeps the cylinders cool.

H and I are the two caps or covers of the cylinders, one of which is represented closed and the other open. Those covers, when down, fit the under side of the exterior cylinder like valves, the edges being carefully ground to a bevel; but they do not close the interior cylinders F and G. In each of these caps there are small valves, through which a part of the rarified air escapes.

D E is the principal beam to which the caps are suspended by chains and rods. This beam is nicely balanced on its centre, and has also attached to it the rods Q R, which will be afterwards explained.

Z Z are two cylinders which contain water; they are open at top; and two air-tight floats, A A, work in them, being raised when the water flows into the vessel by the pipes Y Y (one of which opens into each vessel); and depressed when the water recedes by ascending the pipe J, or K, through the valve L or M.

The pipe J connects the bottom of one of the vessels A Z with the exterior cylinder at F, and the pipe K connects the bottom of the other vessel Z, with the exterior cylinder at G. The depression of the float A in each vessel accompanies the ascent of the water through the corresponding pipe; and the shutting of the valve L or M by its own weight, and that of the water, prevents any of the water which has ascended from returning.

4 is a reservoir, into which the water falls when it has turned the overshot wheel, and is discharged from it. This reservoir supplies the vessels Z Z, through the pipes Y Y, by means of two apertures in the top of the pipes and bottom of the reservoir. These are alternately opened and shut by a slide, which is moved by two knee-cranks, worked by the rods 3 3, attached to the vessel S.

N N is the gas-pipe leading from the gasometer, placed in any convenient situation, and terminating in gas-burners inside the cylinders F and G. In this pipe there are cocks to regulate the supply of gas, and also a cock, moveable by a handle, by which the engine is put in motion or stopped.

o o is a smaller gas-pipe, communicating with the cylinders, and terminating near orifices in the cylinders. The gas is lighted at both extremities of this pipe, and must be kept burning as long as the engine works.

P is a pipe through which air is admitted alternately into the two cylinders, by means of a slide valve, which opens and shuts the orifices of the two branches by turns.

Q and R are rods attached to the beam D E, and leading to the floats in the vessels Z Z. These are pushed up by the floats A A, as they rise, and thus the ends D and F of the beam are alternately raised. V V are arms projecting from the rods Q and R, to which are attached small rods that move the slide valves U U up and down. These slide valves close and open the orifices in the cylinders which admit the ignited gas from the pipe *o o*.

S is an iron or glass tube, half filled with mercury, fixed on a metal plate, from the ends of which proceed small arms or rods with catches and thumb-screws fixed on them, to open and shut the gas cocks alternately. The metal plate is raised and depressed by the projecting arms T, and to it are attached two long rods, which, when drawn up, operate on the cranks in the reservoir 4, and move the slide valve there backwards and forwards.

Q Q are two chains attached to the floats A A, and to the cranks connected with the slide or the air-pipe, which is therefore moved right and left by the alternate fall of the floats.

To effect the vacuum, admit the requisite quantity of gas along the pipe N N into the burners, and also along the pipe *o o*, at the ends of which it must be lighted. Then draw down the end D of the beam, when the cover H will fall and close the top of the cylinder F. The fall also of the rod Q and the arm V, will likewise push down the slide valve U, and close the orifice, making the cylinder air-tight. The flame from the pipe O having issued through the orifice while open, and ignited the gas issuing from the burner and jet, a vacuum will be instantaneously effected by the combustion of the gas, and the water as rapidly raised from the vessel Z by the pressure of the atmosphere on its surface, lifting the clack L by its force upwards, and rushing along the pipe J and the passage-way into the inner cylinder over its top; the fall of the float A will now, by the chain Q, pull the crank, and draw along the slide, and thus admit the air into the cylinder. The water (closing by its gravity the clack at L) will then be discharged through the eduction pipe and its valve, into the trough whence it flows on the overshot wheel, and from thence again into the reservoir 4. The cylinder being full of water, the other float pushing up the rod R, will lift the other end of the beam, and the former end and the cover consequently fall. The gas has been admitted into the cylinder, and ignited; the orifice is closed, and a vacuum is effected in that cylinder in the same manner as it was in the other. The water will now be discharged as before, and the rotatory motion of the water-wheel continued. The rise and fall of the rod R, carrying up and down alternately the arms I I, which embrace a pin in the tube S, raise and lower that end of it, and allow the mercury which it contains to run by turns from one end to the other, by the action of which the gas cocks are opened and shut, and the slide moved backwards and forwards over the entrances to the pipes Y Y, to allow the water to flow alternately into the vessels Z Z, and thus the engine continues to work,—the action being on both sides exactly the same.

When water is intended to be raised from any place, and discharged, the wheel is taken away, and a pipe is brought into communication between the place and the reservoir 4, which is placed just above the level of the water to be raised.

When pistons are worked, the vacuum is produced in the same manner, under the piston, which is forced down by the pressure of the atmosphere, or the vacuum may be effected in one cylinder, and the piston worked in another, by which any number of strokes per minute may be given.

The mechanical parts of these engines may be continually varied; but the *combination by which the vacuum is effected*, and for which the patent is obtained, must always form the *moving power*, and can only be varied in the form of its construction or arrangement.

It is exceedingly difficult to explain, even by the help of an engraving, so very fine a combination of machinery as this; but we hope that what we have said will enable the reader to understand the principle;—to estimate the practical beauty and advantages, he must see the machine itself.

The original power is produced by the condensation of the highly rarified remainder of hydrogen and atmospheric air which remains in the cylinder after ignition; and the proximity of this to a complete vacuum, may be judged of by the fact, that the mercury in the gauge is sustained, even in the model, at about 24 or 25 inches, or, say, 13 pounds of pressure upon every inch of surface. When the vacuum is formed in the cylinder, the pressure of the atmosphere upon the float A, in the corresponding vessel, constitutes the immediate power; and the quantity of water which is forced into the cylinder, and thence discharged upon the water-wheel, is the measure of the effect in one stroke.

Such a machine will speak for itself in terms far more eloquent and appropriate than any of which we could make use. We can only repeat, that the engine can be adopted in any case, by sea or by land, where a power is required; while, even in its present infantine state, the expense, either of the engine itself, or of the working of it, bears no proportion to that of the steam-engine. The quantity of gas which it requires is so small, that, by the model, which of course has all the defects inseparable from a first construction, a single cubic foot raises 300 gallons of water. Besides, no supply of fire, and very little of water, is necessary, there being no waste but the spontaneous evaporation at the common temperature of the atmosphere. It occupies much less room, is not so liable to wear in the working parts, and there is not even the possibility of danger from its use. In short, we have never seen produced by one effort or one man so fine a combination of mechanical and chemical skill, or one which promised to afford so much benefit to the public. Mr. Brown has worked long and hard, but there are none who would not think the labour well paid in the reward—the thanks of a benefitted and admiring public, and that more solid remuneration which Britain secures for her ingenious sons.

The model has been inspected by many of the most eminent engineers and machinists in the metropolis, who have not only been uniform in acknowledging its merits, but expressed their astonishment, that an invention so satisfactory in principle, and so complete in its operation should have been at once brought to such a degree of perfection. Nor does the pecuniary reward to Mr. Brown appear to be at all behind the honourable testimony of men of science,—every day brings orders in great numbers, and from all parts of the country.

DESCRIPTIVE HISTORY OF THE STEAM-ENGINE,

By Robert Stuart, Esq.

Continued from our last).

Mr. Watt, in his first trials with the condenser, procured a vacuum by cooling the condenser externally, as in the first atmospheric engines; but the condensation by this means was very imperfect. He next introduced a jet into the pipe connecting the cylinder and condenser; and in the progress of his improvements, it was introduced in the manner shown in the figure in our last Number. The injection cock was furnished with a lever for the purpose of enlarging or diminishing the aperture by which the jet is formed. This lever and its handle are shown between R and *e*, and *n* is the projection, or box containing the cock.

Mr. Watt's next improvement consisted in availing himself of the expansion of steam when admitted into a vacuum. The parts of what was called his "expansive engine," are, in every respect, the same with those of the one described in our last Number; only the cylinders require to be made of greater dimensions.

In all the engines hitherto described, the steam acts not only to form the vacuum, but to depress the piston. But still, during the operation of the counterpoise, it produces no effect; and where it was required to move machinery, this suspension of impulse was a great drawback on its utility. Before, therefore, it could be considered as a general first mover, this interval required to be much shortened, if it could not altogether be filled up. It was left to Mr. Watt to make this other step towards the perfection of the machine, and he accomplished it by a very slight extension of his first idea.

"He had introduced steam acting against a piston to press it downwards; he now formed a communication between both sides of the piston and the boiler, and also with the condenser, and made the steam act to press the piston *upwards* as well as *downwards*.

"The mechanism was now, as far as the principle went, perfect; and it was reed, for the first time, from the enormous dead weight of counterpoises, which had hung on it from the first attempts of Newcomen; and the equally enormous load which was used in the construction of the various parts, for the purpose of equalizing the motion."

The drawing on page 392, illustrates the application of this improvement.

"The cylinder *q* is inclosed in a jacket or casing like the single engine, having a similar interval, which may be filled with steam or air. The piston *b* is attached to the lever-beam by the rod *x*. 1 2 3 4 are the valves which admit steam to the cylinder, or open a communication between the upper and under sides of the piston, and the condenser. *g* is the pipe leading from the valves to the condenser. *m m*, the levers or spanners, which are elevated or depressed by the tappets or pins *n z*, in the plug-frame, and open or shut the valves to which they may be connected. *h* is the condenser; L, a pipe connecting it with the air-pump *i*, and a second air-pump K. *e*, the piston-rod of this second pump, attached, like the other, *l*, to the lever-beam. F, a pipe from the cold water-pump *q*, to supply the reservoir in which the condenser and its pumps are placed. *k*, a trough or reservoir into which the water heated by the condensation of steam in the condenser, which is raised by the air-pump, is pumped back by M, into the boiler. G, a pulley; and H, an endless chain moving over it, also going round a pulley fixed on the upright axis of the *conical pendulum or governor* x. The other pulley, which is fixed to the axis of the fly-wheel, is not shown in this figure, but its situation and connexion will be clearly seen. R, the handle of the lever which regulates the quantity of injection water admitted. P P, the masonry or wall on which the cylinder and other parts of the machine are placed. *d*, a pipe conveying steam from the boiler to the cylinder. B, a cock or valve, called the throttle-vale or regulator, placed on the pipe conveying the steam from the boiler, and which is moved by the levers shown as supported at D, and connected with the conical pendulum. T Q Q Q W are a system of levers called the parallel motion. X is the axis of the lever-beam *y*.

"The motion at first is produced in this machine in the same manner as in the single engine, by filling the condenser* and cylinder with steam, and then opening the injection-cock.

"This process may be considered to have been gone through, and that the piston has arrived at the top of the cylinder. At this moment the tappets *n n*, and levers *m m*, open the valves 1 and 4, and shut 3 and 2. The steam from the boiler now acts on the upper side of the piston, while a vacuum is formed under it by the valve 4 opening a communication between that part of the cylinder beneath it and the condenser. The piston is, therefore, pressed by the elasticity of the steam to the bottom: when it has arrived at the lowest point, the tappets on the plug-frame, which also descend with the piston-rod, shut the valves 1 and 4, and open 3 and 2. The steam from the boiler, instead of flowing in at the top of the cylinder, is admitted at the bottom, and a communication is opened between the upper end of the cylinder and the condenser: a vacuum is then produced above the piston, and the elasticity of the steam (instead of the counterpoise) forces it upwards. When it is elevated to the required height, the tappets again act on the spanners, and prevent the farther flow of steam beneath the piston, and admits it at its upper end, opening at the same moment a communication between the lower end and condensing apparatus. The motion of the piston is then reversed, and this alternation may be continued indefinitely.

"The mode of pumping out the water from the condenser being the same as

* "'We believe that until Mr. Watt went into Cornwall, the *blowing valve* (in the condenser) had never been applied to any of his engines, it being the usual method to pump out the air by a temporary brake attached to the discharging pump; and that this valve was first applied by Mr. Hornblower at an engine on a mine called Ting Tong, which engine was erected by him for the proprietors of the works.' *Hornblower* in *Gregory's Mechanics*, p. 3[illegible], vol. II."

that in the single engine, will be easily understood from an inspection of our figure. In order to show the four valves in section, a pipe placed in the same direction, and opposite to o, has been omitted in the engraving: it connects the top of the cylinder and the condenser together." * * * *

"When the impulse of the steam impelled the piston only in one direction (downwards), its motion could be imparted to the beam by means of chains, as in the following figure: but when the impulse was to be communicated upwards as well as downwards, some other contrivance for connecting the beam and piston became necessary; and one of the conditions of this contrivance must be, to convert the motion in a curved path of the end of the lever-beam, into a rectilineal motion of the cylinder piston-rod. Mr. Watt, in his earlier engines, used to form the end of the beam as a sector with *teeth*, which worked into a *rack* fixed on the end of the piston-rod: this allowed the rod to move perpendicularly upwards or downwards, but it was very inelegant in appearance, worked with a great noise, and was easily deranged, especially at the instant when the direction of the motion was changed.

"Even after the motion of the piston was equalized by shutting off the steam sooner or later from the cylinder, another source of irregularity was found to arise from the varying quantity of steam, which in different states of the fire under the boiler was admitted into the cylinder: several modes of adjustment occurred to Mr. Watt. The one most generally employed, and probably as accurate as any, was, by placing a valve in the pipe connecting the boiler and the cylinder, which could be made to increase or diminish the steam way. The next improvement was to make this valve, called a *throttle valve*, a self-acting one, and to admit of its being so adjusted, that when the piston was moving with too great a velocity, it would admit less steam into the cylinder, and so diminish its speed, and on the contrary admit a greater quantity when it was moving too slow.

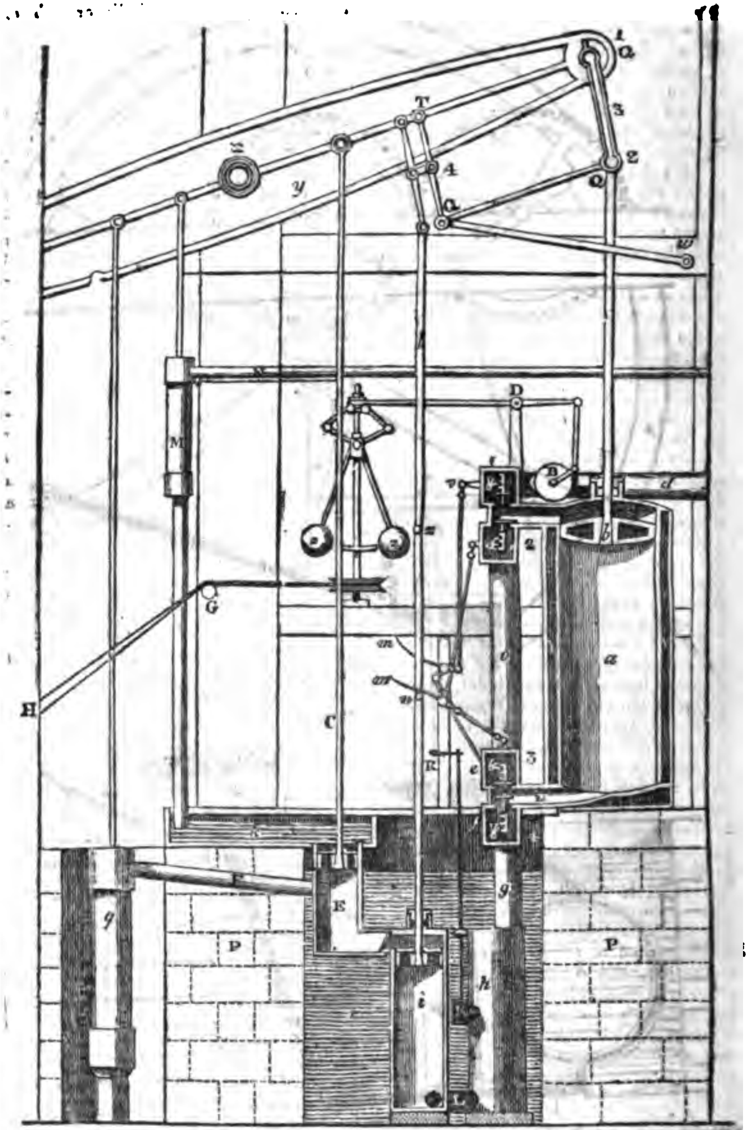
"A similar irregularity in the motion of corn-mills from the varying quantity of water or resistance, had early exercised the ingenuity of millers, to obtain some means by which its injurious effects could be obviated. One of the most usual modes was by means of a couple of heavy balls, attached by a jointed rod, which were made to revolve by being connected with the spindle or axis of the mill-stones. When the stones were moving at a great speed, the meal, by the rise of the stones, was too coarse; and, on the contrary, when the motion was slow, the meal produced was small in quantity and too fine. The attached balls, which were called a *lift-tenter*, by their centrifugal force, either raised or lowered a stage in which the arbour of the spindle revolved, and brought the mill-stones nearer, or removed them farther from each other, as they might be adjusted. This most ingenious regulator was adopted by Mr. Watt, and applied to regulate the opening and shutting of the throttle-valve of his improved engine."

Mr. Watt, by these and other contrivances, having made the reciprocating motion of his engines very regular, next turned his attention to the important object of producing a continuous rotatory motion from a reciprocating one; and this he accomplished by what are now called the sun and planet wheels. It has been found, however, in practice, that nearly the same effect may be obtained in a much simpler manner, and at less expence, by the application of a crank, in the manner of a common turning lathe; and the crank accordingly is now generally employed.

The application of the Steam-engine to the moving of mill machinery gave birth to another contrivance.

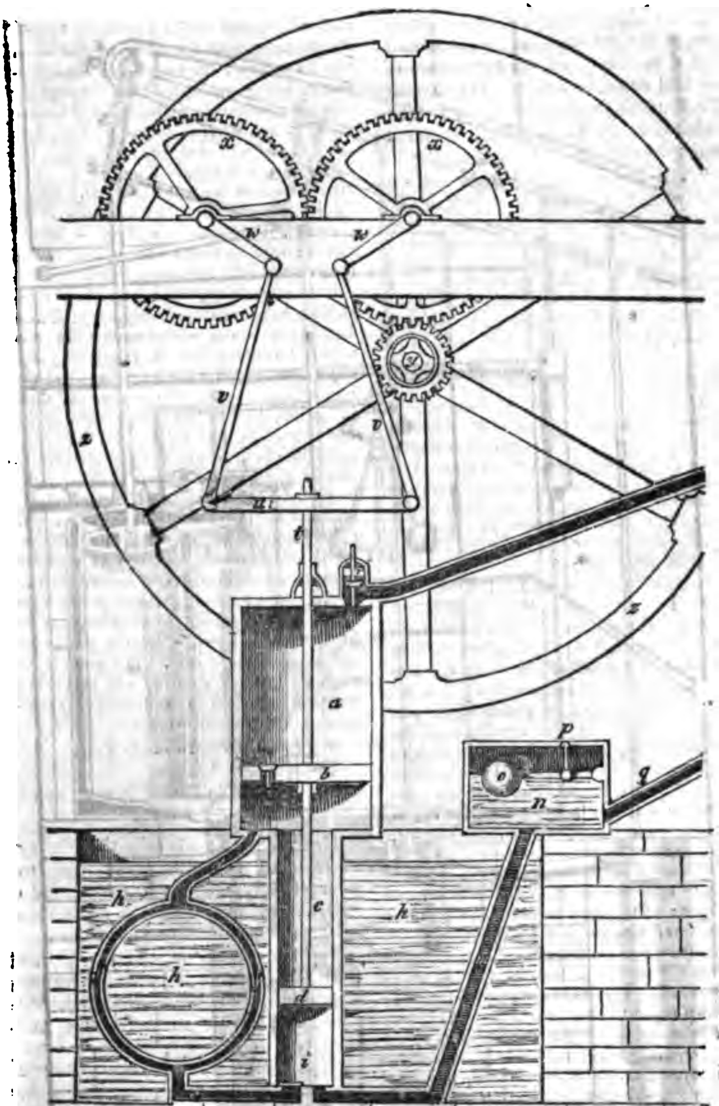
"In the patent of 1782, the double impulse was communicated to the working-beam by the intervention of a sector, placed on the end of the pump-rod, working into a sector placed on the end of the working-beam; but the motion was rough and jerking, and, above all, noisy; and the racks and sectors were very subject to wear. It occurred to Mr. Watt, that if some mechanism could be devised, moving on centres which would keep the piston-rods perpendicular, both in *pulling* and *pushing*, a smoother motion would be obtained. This problem was solved by the invention of the beautiful mechanical combination called the *parallel motion*."

The combination here mentioned is shown in the drawing (p. 399), and was first used in the engines erected at the Albion Mills, near London.



The improvers after Watt, directed their chief attention to the production of a better rotatory engine. Mr. Stuart describes, at length, the different inventions for this purpose of Cooke, Sadler, Kempel, Murdoch, Flint, Clegg, Turner, &c. and is so good as to refer to our pages (pp. 377, 388, Vol. I.) for an "ample detail," and "a good engraving," of Mr. Rider's apparatus, which he considers to be the most practical of those constructed on this principle.

In 1797 the late Rev. Dr. Carte-



wright suggested the advantage of an engine, in which condensation by contact could be accomplished, as saving, in many cases, nearly the whole expence of the fuel. In distilleries, for instance, he conceived that the alcoholic vapour might be introduced under the piston, to raise and depress it by its elasticity, and be condensed without mixing with cold water in the same way as in the worm of a still; or should this not be required, Dr. C. proposed that the boiler could be filled with alcohol; and from the lower temperature required for its conversion into vapour with an elasticity equal to the pressure of the atmosphere, he calculated that a saving of at least one-half of the fuel could be made. We extract Mr. Stuart's description of the engine which Dr. C. constructed on these principles:—

"The piston *b* (see our second engraving in this Number), moving in the cylinder *a*, has its rod *t* prolonged downwards; another piston *d*, is attached to it, moving in the cylinder *c*, and which may be also considered as a prolongation of the steam cylinder. The steam cylinder is attached by the pipe *g*, to the condenser, placed in cold water, formed of two concentric circular vessels, between which the steam is admitted in a thin sheet, and is condensed by coming into contact with the cold sides of the condensing vessel. The water of condensation falls into the pipe *e*. To the bottom of the cylinder *i*, a pipe *m* is carried into a box *n*, having a float-ball *o*, which opens and shuts the valve *p*, communicating with the atmosphere; a pipe *q*, is also fitted to the box. There is a valve placed at *i*, opening into the cylinder *c*; another at *n*, also opening upwards. The pipe *s* conveys steam from the boiler into the cylinder, which may be shut by the fall of the clack *r*. *k* is a valve made in the piston *b*.

"In the figure, the piston *b* is shown as descending by the elasticity of the steam flowing from the boiler through *s*; the piston *d*, being attached to the same rod, is also descending. When the piston *b* reaches the bottom of the cylinder *a*, the tail or spindle of the valve *k*, being pressed upwards, opens the valve, and forms a communication between the upper side of the piston and the condenser; at the same moment the valve *r* is pressed into its seat by the descent of the cross arm on the piston, which prevents the further admission of steam from the boiler; this allows the piston to be drawn up to the top of the cylinder, by the momentum of the fly-wheel *x*, in a non-resisting medium. The piston *d* is also drawn up to the top of *c*, and the valve *i* is raised by the condensed water and air which have accumulated in *e*, and in the condenser *g*. At the moment when the piston has reached the top of the cylinder, the valve *k* is pressed into its place by the pin or tail striking the cylinder cover; and at the same time, the piston *b* striking the tail of the valve *r*, opens it; a communication is again established between the boiler and piston, and it is forced to the bottom as before. By the descent of the piston *d*, the water and air which were under it in the cylinder *c*, being prevented from returning into the condensing cylinder by the valve under *i*, are driven up the pipe *m*, into the box *n*, and are conveyed into the boiler again through the pipe *q*. The air rises above the water in *a*, and when, by its accumulation, its pressure is increased, it presses the float *o* downwards; this opens the vale *p*, and allows it to escape into the atmosphere.

"The machine, from its refined simplicity, appears excellently adapted as a first mover on a small scale. It has never, however, had a fair trial; the objections which were urged against the condensing vessels at the time of their invention, have always appeared to us more specious than solid. To the great merit in the arrangement and simplification of parts shown in this engine, must be added one of immense importance to engines on every construction—*the metallic piston*. Mr. Cartwright constructed his of two plates, between which were placed detached pieces of metal, instead of the usual packing; these pieces were acted on by a spring, so as always to be kept equally tight, whatever might be the wear of the piston. The manner of connecting the piston-rod and procuring a rotatory motion, is a beautiful specimen of mechanical invention."

(*To be concluded in our next.*)

PLAN FOR EXTINGUISHING FIRE AT SEA.

Gentlemen;—I take the liberty of offering a suggestion of mine to your notice, which, if carried into effect, may perhaps prove of service in case of accident by fire at sea.

I propose that every ship of 500 tons should have a row of common hand-pumps affixed to each of her sides, *outside the gunwale*, not less than ten in number; these to have each a leather hose affixed to their spouts, and filled, as regards length, aperture, &c. in the manner of common fire-engine hose. I believe that twenty such pumps, which might be worked by forty men (one at each pump, and one to guide the hose), would throw in a sufficient quantity of water in any case to ensure the extinction of the raging element; and by the hose being of a proper length, the water might be all thrown on one spot, which must render its effect certain.

You will see, Gentlemen, that these pumps being always in readiness, might be worked at a minute's notice, and that they would be no disadvantage to the appearance of a ship compared to the essential benefit they would afford in a moment of danger; besides which, they might be worked in all weathers, and would be of use in cleaning the ship, &c.

The number might vary with the size of the vessel; for instance, fifteen on each side, or one between every two guns, would be sufficient for one of his majesty's frigates.

I have been led to this thought by reading the account of the tremendous fire which in ten minutes drove every soul from the ship "Fame." What would have been the consequence if it had happened far at sea, and in a heavy gale of wind?

I remain, Gentlemen,

Your obedient servant,

R. J. M., *a Seaman.*

[We see no objection to this plan, provided the pumps are so fitted that the fulcrum of the brake shall be moveable, and the lower end of the pipe be so let in to the sheathing as not to impede the vessel's way. If pumps can be thus attached to ships, they would certainly be of great use in cases of fire, and give great facility to the daily operation of washing the deck, as at present it is necessary to carry the water for that purpose from the forecastle aft to the poop.—Edit.]

OBSERVATIONS ON APPLYING A FALL OF WATER TO TURN MACHINERY.

Stranraer, Wigtonshire.

Gentlemen; — In your useful work, Vol. II, page 17, and also page 299, I have taken notice of the application of falls of water to drive machinery by an engine, made somewhat like the common steam-engine, only acted upon by water; and having its power connected by the means of levers, cranks, fly-wheels, &c. &c., for the purpose of giving motion to wheel-work. Here I will take the liberty to propose a plain question, viz.—Should a certain known quantity and fall of a stream of water be applied to act upon a common water-wheel made nearly in diameter equal to the fall of water, and the same water, both in quantity and fall, be put to act upon a piston constructed similar to the common steam-engine; which of these two applications of the same water will have most power to turn machinery? Should it be in favour of the water-wheel, then it follows that the piston acting in a cylinder will not be the way "to make the most of a water-fall." The true value of any thing is its usefulness; therefore, any thing of little use is of little value; this is the case with the piston moved by the pressure-water in a cylinder, &c. to give motion and power to machinery, because, by *actual trial*, the water-wheel gives double the *actual power* to driving machinery. The truth of this assertion is evident to every person who will only consider the loss of power by the necessary parts required to take the power from a straight line, and apply it to that which is a circle. In effecting this circular motion, the parts used must contain a great weight of materials, which are caused to move alternately in different directions, having their accumulated (moving) power in opposition to the power applied for turning the machinery, every time these parts are caused to move in an opposite direction. Notwithstanding this impeding property, it is but little loss of power when compared to the loss arising from the different positions which the crank must be in during the time it receives and communicates power (by the aid of a fly-wheel) to machinery. For, take away the fly-wheel, and all motion ceases, although the pressure of the water remains the same; but this is not the case where the common water-wheel is used. These crude hints may be sufficient to shew the inefficacy of using the piston and cylinder, &c. to make the most of a water-fall. But there may be situations, &c. that may prevent the use of the water-wheel of the usual construction. In this case I think the chain of buckets may be used, as described in your Magazine, page 18, Vol. II. I have seen these employed, and found them troublesome to keep in repair; but looking through your store-house of communications (page 276, Vol. I), there I found the description of a Rotatory Steam-Engine, which is also a water-wheel, and to all appearance well calculated for practical purposes. This wheel seems to possess all the good properties which are not to be found in the alternating engine, where a crank-lever and fly-wheel are necessary appendages to produce a revolving motion. Another thing in favour of this steam and water-wheel is, that the cost will not be so much as a common water-wheel.—Gentlemen, I am,

With much esteem,

AN OLD MECHANIC.

COFFIN CRANE WANTED.

Ipswich.

GENTLEMEN;—While attending at the funeral of deceased friends or connexions, I have been much disgusted at the difficulty there appeared in removing heavy coffins from the bier, and sinking it into the grave. It appears to me that a much more convenient and less painful mode of conducting this operation might be adopted by the invention of a machine to raise the coffin, project it over the grave, and lower it slowly and gradually to the last abode of mortality. Some of your correspondents or readers will probably improve on this hint.—Yours, W. R.

ANOTHER MAGICAL CLOCK.

GENTLEMEN;—The magical clock described at p. 336, Vol. II., is certainly wonderful, but I can mention another which, I think, will lay it completely in the back ground. If you think the following particulars, extracted from an old authority, worth a place in your Magazine, you will oblige me by their insertion.

"A. D. 1571. Convaldus Dusipodius invented the most famous clock at Strasburg. Before the clock stands a globe on the ground, showing the motions of the heavens, stars, planets, viz. of the heavens, carried about by the first mover, in twenty-four hours; of Saturn, by his proper motion, carried about in thirty years; of Jupiter, in twelve; of Mars, in two; of the Sun, Mercury, and Venus in one year; of the Moon, in a month. In the clock itself there be two tables on the right and left hand, showing the eclipses of the Sun and Moon, from the year 1573 to 1624. The third table in the midst is divided into three parts: in the first part the statues of Apollo and Diana show the course of the year, and the day thereof, being carried about in one year; the second part shows the year of our Lord, and of the world, the equinoctial days, the hours of each day, the minutes of each hour, Easter-day, and all other feasts, and the dominical letter: the third part hath the geographical description of all Germany, and particularly of Strasburg, and the names of the inventors, and all the workmen. In the middle part of the clock is an astrolabe, showing the sign in which each planet is every day; and there be the statues of the seven planets upon a round piece of iron, lying flat, so that every day the statue of that planet that rules the day comes forth, the rest being hid within the frames, till they come out by course at their day, as the Sun upon Sunday, and so for all the week. And there is a terrestrial globe, and the quarter, and the half hour, and the minutes, are showed there. There is also the skull of a dead man, and two statues of two boys, whereof one turns the hour-glass when the clock hath struck, the other puts forth the rod in his hand at each stroke of the clock. Moreover, there be the statues of the Spring, Summer, Autumn, and Winter, and many observations of the Moon. In the upper part of the clock are four old men's statues, which strike the quarters of the hours, the statue of Death coming out each time to strike, but being driven back by the statue of Christ, with a spear in his hand, for three quarters; but in the fourth quarter, that of Christ goeth back, and that of Death striketh the hour, with a bone in his hand, and then the chimes sound. On the top of the clock is the image of a cock, which twice in the day croweth aloud, and clappeth his wings. Besides, this clock is decked with many fine pictures, and being on the inside of the church, carrieth another frame to the outside of the wall, wherein the hours of the Sun, the [illegible] of the Moon, the length of the day, and such other things are set forth with great art."

From yours, &c.

T. M. B.

MR. CAREY'S IMPROVED IRON KNEE.

Bristol, August 13, 1824.

GENTLEMEN;—In answer to your correspondent G. B., respecting my newly invented iron knee, I beg to say, that if it should prove faulty from bad workmanship, it can be removed with the greatest facility. Unbolt the beam-arm on each side, unship the beam, and drive out the bolts through the side; the knee will then be loose: send it on shore to be repaired; when done, put it in its place again; unbolt the knee through the side; ship the beam, and bolt that through the beam-arm, as before; the beam and the ship-side will then be fast: this can be done in any country. The difference in price is trifling, compared with the advantage gained. The improved knee acts as four knees, and fastens with fewer bolts than the old knees; and it is evident to all, that the four throat-bolts in my knee will all bear an equal strain without the possibility of twisting or bending. A ship that labours much, will strain and bend the knees in the old way; this causes the seam to open in the water-way, lets in the water, and the ship goes to decay. If G. B. will favour me with his real name and address, I will give him any further information in my power respecting my improvements in shipping, of which I have a few.

I am, Gentlemen, yours, &c.

EDWARD CAREY,

Surveyor of Shipping, Bristol.

ARTIFICIAL WAX.

GENTLEMEN;—In your Magazine, I observe (Vol. II. p. 319) an account of "artificial wax." I should be glad if any of your correspondents would give some information of the process. I have made some attempts to harden tallow, but without success.

Your obedient servant,

J. G

MAKING IRON RED HOT WITHOUT FIRE.

GENTLEMEN;—I take the liberty of communicating to you a curious method of hammering iron without fire, and making it red hot. Take a piece of round iron, about an inch thick, at one end of which fix a round iron knob; then begin gently to hammer it under the knob; by turning it quickly round, and following your strokes harder and harder, the iron will heat of itself, and begin to be red hot; the reason is, because the knob remains untouched, and the heat of the motions cannot dissipate.

I am, Gentlemen, yours, &c.

W. H.

Horse-Stealing Bar.—N. B. Your correspondent W. A. D. does not give a full enough explanation respecting the nut and screw in his bar against horse-stealing: how is it to be fastened? If it be fastened in the inside, the person on the outside could not get in; and if on the outside, any one might get in with a key to fit the top of the screw.

VALLENCE'S CROSS-CUTTING SAW.

GENTLEMEN;—In your 32nd No. is described a new cross-cutting saw, invented by Mr. Dixon Vallence. Will that gentleman, or any of your correspondents, have the goodness to explain how it is to be used horizontally with a length of pendulum from six to twelve feet; as, in that case, a tree standing cannot be cut nearer the ground than the length of the pendulum. Your draughtsman, I think, has made a mistake, by inserting the saw in a frame, which would prevent the saw going deeper than what is left clear.—Yours, &c.

NAUTICUS.

LONDON IMPROVEMENTS.

GENTLEMEN;—I beg to hand you an extract from a work published in 1734, entitled "A Critical Review of the Public Buildings, Statues, and Ornaments of London and Westminster;" and as it shows how improvements were at that time conceived, which are now apparently about to be carried into effect, I trust it will be considered worth inserting.

"The fire of London furnished the most perfect occasion that can ever happen in any city, to rebuild it with pomp and regularity. This *Wren* foresaw, and, as we are told, offered a scheme for that purpose, which would have made it the wonder of the world. He proposed to have laid out one large street from *Aldgate to Temple-bar*, in the middle of which was to have been a large square, capable of containing the new church of St. Paul's, with a proper distance for the view all round it; whereby that huge building would not have been cooped up as it is at present, in such a manner as no where to be seen to advantage at all; but would have had a long and ample vista at each end, to have reconciled it to a proper point of view, and give it one great benefit, which, in all probability, it must now want for ever. He farther proposed to rebuild all the parish churches in such a manner as to be seen at the end of every vista of houses, and dispersed in such distances from each other, as to appear neither too thick nor thin in prospect, but give a proper heightening to the whole bulk of the city, as it filled the landscape. Lastly, he proposed to build all the houses uniform, and supported on a piazza, like that of Covent Garden; and by the water-side, from the bridge to the temple, *he had planned a long and broad wharf, or quay*, where he designed to have ranged all the halls that belong to the several Companies of the city, with proper warehouses for merchants between, to vary the edifices, and make it at once one of the most beautiful and most useful ranges of structure in the world. But, as I said before, the hurry of re-building, and the disputes about property, prevented this glorious scheme from taking place."

I am, Gentlemen,

Your most obedient servant,

JULIUS.

[Chevalier de Wiebeking, who was the first in modern times to revive this project of forming a quay or terrace along the river (in his work on Hydraulic Architecture, published at Munich in 1809), is of opinion that it would have been more advantageous for the trade and commerce of the city of London, if a solid quay had been constructed from Westminster bridge down to London bridge; and if, in the place of one great bason, several small basons had been excavated in different parts of the town, which, by means of locks, would have communicated with the river. The dimensions of these small basons he fixes to 120 feet breadth, and to 4 or 500 feet length. M. de Wiebeking further proposes to join these small docks together by a canal parallel to the quay, which would produce the advantage of scouring alternatively, as the tide served, every one of these basons by the water contained in the other ones. At the side of this canal and the docks, warehouses of different descriptions could be constructed, and thus the mercantile depôts would have been nearly central in the metropolis; besides this advantage, the water in the canal would have been of great use in case of fire.

The Chevalier concludes his observations with the following passage (page 190): "According to this plan, the length of the bridges of Westminster, Waterloo, Blackfriars, and Southwark, would have been considerably lessened, and the saving thus produced would have been more than sufficient for the building of a new bridge in the place of London Bridge; the great expense of the London docks would have amply covered the costs of the execution of the plan, which I have thus sketched in its outlines, if it had been proposed and attended to at the proper time. But at present the objects which are most deserving of the public attention, are the construction of a new bridge in the place of London bridge, and of a regular solid quay along the banks of the river. It is a matter of doubt, whether, notwithstanding the excavation of the London docks, the small ship-basons which I proposed, would yet be of moment and use for the trade."—EDIT.]

INFLAMMATION OF SULPHURETTED HYDROGEN BY NITRIC ACID.

When a few drops of nitric acid are put into a flask, filled with sulphuretted hydrogen, the hydrogen is divided by the nitric acid, and the sulphur is disengaged in a solid form. If the flask be closed with the finger, so that the gas, which becomes heated, cannot escape, its temperature is raised so much as to produce combustion, with a beautiful flame, and a slight detonation, which forces the finger from the mouth of the flask. This experiment may be made without the least danger, with a flask containing four or five cubic inches of gas. BRANDE.

ANSWERS TO INQUIRIES.

DIVIDING A CIRCLE INTO TWO OVALS.

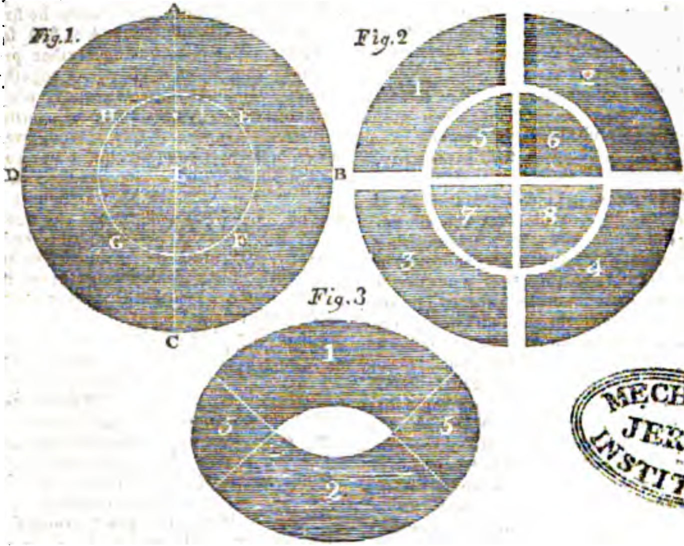


Fig. 1. Fig. 2. Fig. 3

Portsmouth, June 21, 1824.

GENTLEMEN;—If G. A. S. has asked the question (No. 36 among your Inquiries, in the 43rd Number of your Magazine) for the sake of exercising the ingenuity of your various readers, I shall have to regret if my reply should prevent others from attempting to discover a better mode for effecting the desired purpose. But, if your correspondent really means that he has a circular veneer of beautiful wood, which he wishes to make the most of in converting it, as he has stated, I shall feel happy, if my explanation to the accompanying rough figures should assist him. Let A B C D (figure 1) be the veneer, supposed to be four feet in diameter; place one point of your compasses in the centre, and describe a circle, whose diameter shall be equal to half the diameter of the veneer, or two feet; I have then the circle E F G H within A B C D, both having the common centre L. Divide the circumference of the veneer into four equal parts, as at A B C D, and join these four points of division by two straight lines passing through the centre L; that is, draw a line from A to C, and another from B to D. Cut the veneer nicely in the direction of these lines, and you will then have eight pieces, as represented in figure 2, viz. Nos. 1 2 3 4 being equal portions of the larger circle A B C D, and 5 6 7 8 being equal portions of the smaller circle E F G H. Take Nos. 1 and 2, and place them together, in the manner shown in figure 3, and fill up the blank spaces, which will be left at the two ends of this figure, with the pieces 5 and 6, which, if cut out correctly, according to the lines drawn in figure 1, must exactly fit the vacancies. The four remaining pieces, 3 4 7 and 8, must be placed together in a similar manner: we shall then have two beautifully proportioned ovals. The vacant space in the centre of each, may be either cut into the shape of a small oval, or left as it is, and filled up with a veneer of some other wood, neatly crossbanded, &c. &c.

I *believe* it is not possible to *complete* the two ovals from one circle, without numberless joints and very great waste. In this case, not one atom of the veneer will be lost beyond what the saw will take away, and a very few fine shavings in making the joints. The vacancies in the centre of the oval, if properly managed, and filled up with taste and good workmanship, will constitute an improvement rather than a defect, in the general appearance of the table. I shall be happy if these hints prove in any way useful to G. A. S., or any other of your readers;

and it would give me considerable pleasure to be informed of any better means of effecting this purpose.

I am, Gentlemen, yours, &c.

HENRY DEACON.

[Similar solutions of the question have been received from Q. T.—James Marsh—Juvenis—R. A, and Divisor.—EDIT.]

REFINING GOLD, No. 43.

Pride-Hill, Shrewsbury,
August 18, 1824.

GENTLEMEN,—In Nos. 49 and 50 of your Magazine, I perceive several answers to my inquiry (No 42) respecting the refining of gold. The information given by "Rose Colin" is not exactly what I want; and the process recommended by "G. Stacey," although, perhaps, correct, is too difficult and tedious for general use. I regret to find that the *knowing ones* are as close-fisted in London as in the country. Unfortunately for "A Working Jeweller, W. M.," and "A Journeyman Jeweller, N. M." (who are so very desirous of visiting Shrewsbury at my expense), since I wrote to you, I have obtained a distinct and simple account of the process from a friend in the Glasgow university, by which I have succeeded, at the first trial, in perfectly purifying both gold and silver, notwithstanding "W. M.'s" assertion, that "*if volumes were written, it would be of no avail.*" As soon as I can obtain my friend's permission, I shall send you a copy of the process for insertion; and trusting your Magazine may be useful in bringing to light many other valuable secrets, which are at present in the hands of a few mercenary individuals,

I am, Gentlemen,
A Constant Reader
NILOC ESOR.

INQUIRIES.

No. 61.—DIVIDING CIRCLES AND ELLIPSES.

GENTLEMEN;—I have often been puzzled in the perspective drawing of machinery, and making models of wheel-work, to divide the circumference of "circles and ellipses" into any proposed number of equal parts. I shall, therefore, be exceedingly obliged if any of your correspondents will inform me, through the medium of your Magazine, how this may be most easily and correctly performed.

G. F.

No. 62.—CASE-HARDENING WROUGHT IRON.

GENTLEMEN;—I should feel infinitely obliged, if some of your kind correspondents would inform me the most certain, and effectual method of "case-hardening wrought iron;" say a piece two inches diameter each way, to be hardened one-tenth of an inch deep, *or more*, below the surface. I should also like to know which is the best and clearest sort of iron for the purpose.

R. O. N. M.

No. 63.—SILVERING DIAL-PLATES.

Tavistock.

GENTLEMEN;—I should feel obliged to any of your intelligent readers to communicate the best method of "silvering dial-plates." The modes laid down in most of our encyclopædias are found to be inefficient and erroneous.

T. H. SNELL.

NEW PATENTS.

To Philip Taylor, of the City-road, Middlesex, engineer; for certain improvements on steam-engines.—3rd July.

To John Lane Higgins, of Oxford-street, Middlesex, esq.; for certain improvements in the construction of the masts, yards, sails, and rigging of ships and smaller vessels, and in the tackle used for working and navigating the same.—7th July.

To William Hirst and John Wood, both of Leeds, Yorkshire, Manufacturers; for certain improvements in machinery, for the raising or dressing of cloth.—7th July.

To Joseph Clisold Daniell, of Stoke, Wiltshire, clothier; for an improved method of weaving woollen cloth.—7th July.

To Charles Philips, of Upnor, Frindsbury, Kent, esq.; for certain improvements on tillers and steering wheels of vessels of various denominations.—12th July.

TO CORRESPONDENTS.

Answers to a numerous [illegible] correspondents in our next.

Communications (post paid) to be addressed to the Editors, at
THE PUBLISHERS,
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55, *Paternoster-Row, London.*

T. C. Hansard, Pater-noster-row Press.

Mechanic's Magazine,

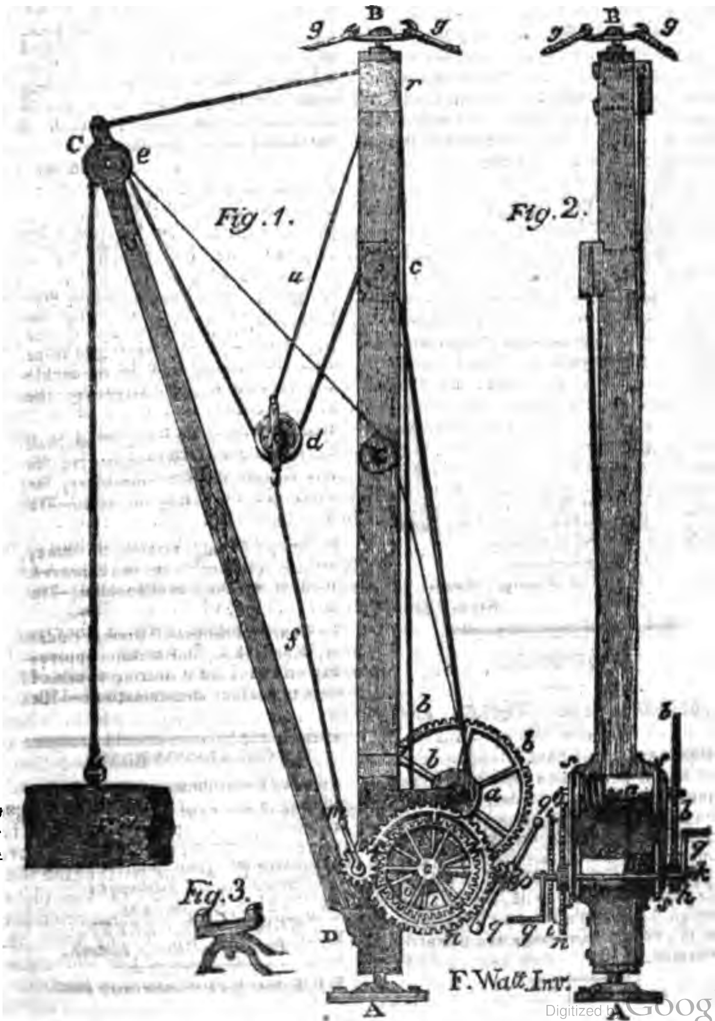
Museum, Register, Journal, & Gazette.

"The most valuable gift which the Hand of Science has ever yet offered to the Artizan."—*Dr. Birkbeck.*

.... Without employ,
The soul is on a rack; the rack of rest
To souls most adverse, action all their joy.—*Young.*

No. 54.] SATURDAY, SEPTEMBER 4, 1824. [Price 3d.

WATT'S JIB CRANE.



WATT'S JIB CRANE.

It is not more trite than true, that many of the most valuable improvements in the arts, and more especially in practical mechanics, have been made by common workmen, who, from situation and circumstances, have been unable to reap the fair and proper reward of their genius; and who have lived in poverty, obscurity, and neglect, while the public were enjoying the benefit of their inventions, and sometimes while men of less talent but more worldly prudence and cunning, were laying claim to the inventions themselves; thus depriving the proper inventors both of their emolument and their honour. It must, indeed, be admitted, that the workman who has both the head to invent and the hand to execute, has not always that prudence which is necessary for insuring success in the world. Absorbed and occupied by his inventions, he has no time, and will not descend to calculate the result in pounds, shillings, and pence. Besides, a workman of superior abilities is always courted and caressed by his fellow-workmen: they need his advice and assistance; and the usual way of paying him for these, is by a treat in the ale-house. That which at first is only the receiving of a courtesy, becomes a habit through time; and the man is lost both to himself and to society.

To prevent this fatal, and, we fear, rather frequent result, would be a most desirable matter—although we are not prepared to say how it could be done; and, indeed, leaving this altogether out of the question, we know of no means by which a poor man can at present secure to himself the advantages of any invention, however important. The Patent Office was perhaps intended for the encouragement of inventive genius; but, as at present managed, it does not answer that intention. The fee for all inventions, great and small, real and pretended, is nearly the same; and the amount of it is such as to preclude the application of any labouring mechanic. By this means, ninety-nine hundredth parts of the talent which would be at work in the invention and improvement of machinery, is laid on the shelf; and the office which may have been meant for the encouragement of that talent, is haunted by quacks and impostors.

These observations have been forced upon us when we reflected upon the difficulty that we had in finding out the inventor of the very ingenious and useful crane which is the subject of this article: and all that we have been able to ascertain concerning him is, that his name was Francis Watt; that he was born at or near Aberdeen; that he worked as a journeyman carpenter at the bridge over the Spey at Fochabers, and at the Caledonian Canal; that he was for some time foreman of the carpenters at the construction of the Bell-Rock Lighthouse; that, while there, he invented this jib-crane, together with a very ingenious counterpoise one (of which we shall afterwards give a drawing and description), and gave a design for the temporary beacon which was set up up on the Bell-Rock; that, from the Bell-Rock, he came to England, in the service of Mr. Rennie, the engineer of that and many other great works; and that, after being for some time in the service of Mr. Rennie, he left it, and went—we know not whither. It does not appear that Mr. Watt gave himself any trouble about those cranes, farther than furnishing the original idea and rough sketch from which they were constructed for the building of the Bell-Rock Lighthouse, the place where they were first used: and we are induced to lay them before our readers, both because they deserve to be better known, and lest some one to whom it does not belong, should arrogate to himself the merit of their invention.

The jib-crane possesses several advantages over the [illegible] commonly in use; but [illegible] more easily understood [illegible] described the several parts of the machine, as represented in the plate. The form and dimensions are taken from a crane which has been for several years used at the works carrying on at the Dundee Harbour; and although some alterations might perhaps be made, we shall first describe the nature and uses of the crane, and then point out these alterations.

Explanation of the Plate.

Fig. 1 is a side view of the crane, showing the jib; fig. 2 is a back view, showing the chain, barrels, and edges of the wheels and pinions; fig. 3 is a fulcrum, used in shifting the crane from place to place. The same reference-letters are put to the same points in both figures.

A B is the upright shaft. It is made of a firbalk 12½ inches square, and 23 feet long. Its lower pivot turns in a cross step at A, and its upper one in a cross at B, supported by four gy-ropes, two of which (*g g*) are shown in each figure. Immediately above the pivot are two strong plates of cast-iron, bolted to the opposite sides, for receiving the bolt at D, upon which the jib turns. Above these, the shaft is fortified by side pieces, till it has a breadth of 26½ inches, where are fastened the cast-iron cheeks (*s s*), of which an edge view is given in fig. 2, and which may be traced behind the wheels *i i* and *n n*, in fig. 1. Four brass beds, covered by cap squares of the same metal, are placed in these cheeks for receiving the axles of the wheels and pinions. Two strong cast-iron blocks, with grooved pulleys for the chains, are placed at *c* and *r*, upon opposite sides of the shaft.

C D is the jib, formed of two oak battens, 7½ inches by 2¾ at their lower extremities, and 5½ by 2½ at their upper. They are 3 inches asunder at the lower extremity; where, and at the serpentine plate at the middle, they are separated by blocks, and they meet within a few feet of the upper extremity. The extremity D is fortified by two strong plates of cast-iron, which go withinside the plates in the shaft, and receive the axle-bolt; and other two plates at the extremity C, contain a grooved pulley, shown by the dotted circle at *e*, and a bolt for fastening the chain C *r*. The length of the jib from the axle-bolt at D to the centre of the pulley *e*, is 20½ feet.

There are two chain-barrels. The barrel *a* raises or lowers the weight *f*, by means of the chain which passes over the pulleys *c*, *d*, *e*; and the barrel *o* contracts or expands the jib, by means of the chain which passes over the pulley *r*. The crane-barrel (*a*) is about 9½ inches in diameter, and the jib-barrel (*o*) about 8 inches; and the chains for both are made with circular links from five-eighths inch iron road. These barrels may be either both worked at the same time, in the same or in opposite directions, or either of them may be worked separately.

The jib-barrel has a single power, produced by the pinion *p*, of 10 leaves, and 5½ inches diameter, acting on the wheel *n n*, of 76 teeth, and 36½ inches diameter. The pinion *p* is moved by the winches *q q*, which have a lever power of 16 inches. The jib-barrel may be locked by pushing the moveable bolt *v*, till it bear against an arm of the wheel *n n*. The single power of the crane-barrel is obtained by placing winches (16 inch) on the squares *k k* (fig. 2), which terminate an arbor passing through the centre of the jib-barrel, and having on its one end the wheel *i i*, and on its other the pinion *h* (fig. 2). The pinion *h* (5½ inches diameter, 9 leaves), moves the wheel *b b*, which is fastened on the arbor of the crane-barrel, and has 36½ inches diameter, and 76 teeth.

The double power is obtained by turning the pinion *l* by means of the winch *m* (16 inches), and one on the opposite end of the same arbor. The pinion *l* is 8½ inches diameter, and has 16 leaves, and the wheel *i i*, which it turns, is 32 inches diameter, and has 66 teeth.

The check-block *d* is a single pulley, kept in its place by the chains *t*, *u*, and is necessary for securing the action of the jib at all angles of elevation, by preserving the angle D *e d*, always smaller than the angle D *e f*, it being obvious, from the doctrine of the resolution of forces, that when these angles are exactly equal, the point of the jib will be in equilibrio; but that when they are unequal, it will have a tendency to move in the direction of the greater angle. When D e f is the greater, the jib can be prevented from falling down by the jib-chain C r; but if D e d were the greater, there is nothing to prevent it from rising till it would come in contact with A B.

The fulcrum (fig. 3) is, when the crane is to be shifted, placed near the axle-bolt of the jib at D; then the jib is lowered, and acts as a lever in taking the weight of the crane off the cross-foot. The cross-head of the fulcrum moves on a pivot in the tripod, and by means of it, and easing off two of the gy-ropes while the opposite ones are hauled in, the crane is moved along in an upright position.

The total cost of such a crane is about £70; and the parts are so constructed, that it may be used for many years without requiring the smallest expense for repairs.

The power of the jib-barrel, without making allowance for friction, is about 26½, when the winch is in an horizontal position; but as the resistance of the weight varies with every change in the elevation of the jib, it is not possible to calculate the power which would be necessary to move it with any given weight. The more that the jib is elevated, the less power is required. The single power of the crane-barrel, without making allowance for friction, is about 24½, and the double power about 101. It is not possible to determine the friction exactly, because it varies both with the weight and the position of the chains, being more as the weight is greater, and the angles formed by the chains less. But the result of experiments made with a load of one ton, and the jib at an angle of about 45 degrees, were as follows:—

Single Power.

	lbs.
Power required to suspend a ton, by calculation, about	91
Ditto, by trial with check-block, about	154
Total friction	63
Ditto, without check-block	128
Friction on check-block	26

Double Power.

	lbs.
Power required to suspend a ton, by calculation, about	[illegible]
Ditto, by trial, with check-block, about	[illegible]
Total friction	[illegible]
Ditto, without check-block	[illegible]
Friction on check-block	6

Hence the whole friction on the single power is equal to about two-fifths, and that on the double power about one-half of the power employed; and the friction upon the check-block nearly one-seventh of the power in both cases. The small arc, however, over which the winch can traverse, without a great alteration of power, when trial is made by weights suspended from the winch, and the great strain produced by a pressure of two tons on the machine, render such experiments but very loose approximations.*

As a building crane, this possesses many advantages over those commonly in use, from the complete command it has over every inch of space within the range of the jib. The common building crane, with a fixed jib and moveable truck, commands, indeed, the same angular range; but then the truck cannot, without an additional power, be removed farther from the shaft, after the crane is loaded, and thus its operation is confined. The common crane is also much less portable, and cannot be moved even for the shortest distance,

* Still it is evident, that, could the check-block be dispensed with, the power of the crane would be very much increased. Now, if the point of the jib did not require to be very much raised, the block might be dispensed with by giving the pulley c a situation lower down the shaft, such as z; but if it were brought very low, the chain would not coil properly on the barrel. This might, however, be obviated, by placing the crane-barrel on the other side of the shaft, and bringing the chain down the back of the jib from the pulley e, without passing it over any other pulley whatever. As, however, the placing of the barrel in this situation, would prevent the jib from being brought so near to the shaft as it can be with the check-block; and as, notwithstanding the friction on the block, the crane is sufficiently powerful, the alteration is a matter of less importance.

without being taken down—an operation which costs a good deal of time and labour. Indeed, in as far as portability, power, and the complete command of a given space are concerned, this crane is decidedly superior to every other; and in every case of building with large stones, where gy-ropes can be used, it deserves the preference. Where gy-ropes cannot be used, Mr. Watt's balance, or counterpoise crane, is equally applicable and excellent. Indeed, the whole machines invented by this ingenious mechanic, while employed at the construction of the Bell-Rock Light-House, form a series of applications of the mechanical powers highly unique and valuable; and show of how much consequence it would be to the arts and to society, were mechanical genius in common workmen duly appreciated and regarded.

New Menstruum for Etching Steel Plates, invented by Mr. Edmond Turrell, *Engraver.*

Take four parts, *by measure*, of the strongest pyroligneous acid, chemically called *acetic acid;* and one part of alcohol, or highly rectified spirits of wine; mix these together, and agitate them gently for about half a minute; then add one part of pure nitric acid; and when the whole are thoroughly mixed, it is fit to be poured upon the steel plate.

When the mixture is compounded in this proportion, very light tints will be sufficiently corroded in about one minute, or one minute and a half; and a considerable degree of colour will be produced in about a quarter of an hour. But the effect may be produced much quicker by the addition of more nitric acid; or it may be made to proceed slower, by omitting any convenient portion thereof.

When the mixture is poured off the plate, it should be instantly washed with a compound, made by adding one part of alcohol to four parts of water; and the stopping-varnish, laid upon any part that is sufficiently corroded, should be thoroughly dry before the biting is repeated. Care should be taken to keep the mixture out of reach of the sun, or any artificial heat; because its valuable properties for this purpose would thereby be changed. It will be necessary also to observe, that no more of the ingredients should be mixed than are wanted for present use, as the mixture will be greatly changed if kept many hours.

Care must be taken not to use the common Brunswick-black, sold in stone-bottles at the various oil-shops. This article is generally made by dissolving English asphaltum, prepared from coal-tar, in the essential oil of turpentine, and digesting therewith a small quantity of spirits of wine, which, if properly managed, causes it to dry very quickly; and, on that account, it is found very convenient for stopping-out on copper-plates; but a little reflection will readily suggest, that this is a very improper compound to stop-out with, where alcohol forms one of the articles used to dilute the acid, as is the case in the compound given above. The stopping-varnish that answers the purpose best, is made by dissolving the best Egyptian asphaltum in the essential oil of turpentine, which dries sufficiently quick for all desirable purposes, and perfectly secures the part covered with it from the action of the menstruum. As a proof of this, I have used the varnish, so made, upon a steel plate etched by Mr. Bromley, jun., two feet eight inches long, by two feet wide; and, although the stopping-out was frequently repeated, yet it resisted the action of the acid to the last, the whole time of biting-in being about eighteen minutes.

On the Colour of Gold, and the Methods of Restoring it when Sullied. By the late William Lewis, M. D.*

The bright and deep yellow colour of gold, commonly distinguished by its name, is one of the most obvious characters of this metal. Its colour and beauty are of great durability, not being injured either by air or moisture, nor by any kind of exhalations that usually float in the atmosphere; as may be observed in the gildings of some public edifices, which have resisted the weather, and the vapours of London and other populous cities, for half a century, or more. In this property consists a great part of the excellence of this metal, for ornamental and some mechanical uses. There is no other malleable metallic body so little susceptible of tarnish or discoloration, or so little disposed to communicate any stain to the matters with which it lies in contact.

* From his "Commercium Philosophico-Technicum."

As instruments or ornaments of pure gold are liable to be sullied, only from the simple adhesion of extraneous substances, their beauty may be recovered without any injury to the metal, however exquisitely figured; or without any abrasion of its surface, however thin and delicate, by means of certain liquids which dissolve the adhering foulness; such as the solution of soap; the solution of fixed alkaline salts, or alkaline ley; volatile alkaline spirits (*ammonia*); and rectified spirits of wine.

In the use of all alkaline liquors, some caution is necessary in regard to the vessels employed; those of some metals being, in certain circumstances, corroded by them, so as remarkably to discolour the gold. A gilt snuff-box, boiled with soap-boiler's ley, in a tin-pot, to clean it from such foulness as might adhere in the engraved figures, and to prevent any deception which might thence arise, in a hydrostatical examination of it, became soon of an ill colour, and at length appeared all over white, as if it had been tinned. Some pieces of standard-gold, treated in the same manner, underwent the same change; and, on trying alkaline spirits, prepared with quick-lime, the same effect was produced more speedily. On boiling the pieces, thus whitened, with some of the same kinds of alkaline liquors in a copper vessel, the extraneous coat disappeared, and the gold recovered its proper colour.

For laces, embroideries, and gold thread woven in silks, the alkaline liquors are in no shape to be used; for, while they clean the gold, they corrode the silk, and change or discharge its colour. Soap also alters the shade, and even the species of certain colours. But spirits of wine may be used without any danger of its injuring either the colour or quality of the subject; and, in many cases, proves as effectual for restoring the lustre of the gold, as the corrosive detergents. A rich brocade, flowered with a variety of colours, after being disagreeably tarnished, had the lustre of the gold perfectly restored, by washing it with a soft brush dipped in warm spirits of wine; and some of the colours of the silk, which were likewise soiled, became, at the same time, remarkably bright and lively. Spirits of wine seems to be the only material adapted to this intention; and, probably, the boasted secret of certain artists is no other than this spirit disguised: among liquids, I do not know of any other that is of sufficient activity to discharge the foul matter, without being hurtful to the silk. As to the powders, however fine, and however cautiously used, they scratch and wear the gold, which is here only superficial, and of extreme tenuity.

But, though spirits of wine is the most innocent material that can be employed for this purpose, it is not, in all cases, proper. The golden covering may be in some parts worn off, or the base metal with which it has been iniquitously alloyed, may be corroded by the air, so as to leave the particles of the gold disunited; while the silver underneath, tarnished to a yellow hue, may continue a tolerable colour to the whole: in which cases, it is apparent that the removal of the tarnish would be prejudicial to the colour, and make the lace or embroidery less like gold than it was before. A piece of old tarnished gold lace, cleaned by spirits of wine, was deprived, with its tarnish, of the greater part of its golden hue, and looked almost like silver lace.

Though no one of the other metallic bodies, singly, has any degree of the beautiful yellow colour which glows in gold, the true yellow colour may, nevertheless, be pretty nearly imitated, by certain combinations of other metals, particularly of copper with zinc; but how nearly soever these compositions approach to gold, in degree or species of colour, they differ greatly in its durability: and their differences, in other respects, are still more strongly marked, and of more easy discovery.

THOUGHTS ON A FORM FOR A STEAM-VESSEL, BY WHICH THE EXTERNAL MACHINERY WOULD BE PROTECTED FROM THE ACTION OF THE SEA.

The attempts which have been made to give a rapid progressive motion to vessels, by inserting one or two wheels through the bottom, have proved ineffectual, for two principal reasons, viz. the depth at which the valves acted, and the repelling force given by the water cast from the paddles against the body of the vessel.

Double vessels have long since been formed, but have proved inefficient, when acted on by the wind, and hitherto, from their construction, have been deemed unfit to resist the continued force of the sea.

The difficulties arising from the

mal construction of these vessels may be obviated, and the usual machinery of a marine steam-engine applied with advantage.

Let there be constructed two very narrow vessels, of light draught of water, exactly similar, with their entrance and run extremely fine. About a foot above the water-mark the ribs should turn outwards, and be united by short and powerful pieces of oak. The beams should be of one length, *i. e.* reaching from the larboard side of one hull to the starboard of the other.

The length of the strong uniting pieces would depend on the size of the vessel, as the wheel by which the vessel is immediately propelled, would be inserted in the centre, between the two hulls. It is evident that there would be a complete arch between the two hulls. As soon as progressive motion is given to the body, the water would, to a certain degree, be compressed between the hulls, and act like a stream against the revolving paddles, and thus add to the force applied, and tend to give increased velocity to the vessel. As the arch would be as open at the stern as forward, there would be no substance to oppose the free passage of the water, consequently the propelling power would not be counteracted as in vessels with wheels through the bottom.

This species of vessel could not plunge so deep into the sea as the common vessel, as the water would come in contact with the top of the arch, and so not only prevent the bow from sinking into the sea, but tend to raise it. The rolling of the vessel would be considerably diminished, since there would always be acting as a preventive the weight of one of the hulls. The wheel or wheels would be effectually protected from the action of the sea on them, greater space on deck would be gained, and such separation in the vessel as might be advantageous in packets. The two rudders should be under the direction of one tiller in the centre, which a very simple piece of machinery would procure. The sails of steam-vessels are, comparatively speaking, of little use; for if the wind is blowing at the rate of ten miles an hour, and the steam-boat is propelled by another power eight miles an hour, the power of the wind is only equal to two miles. The double vessel might have two masts, one in each hull, slanting towards each other, and meeting in the centre, where there should be the haulyard block for a *lug-sail;* the yard of the lug-sail should also be slung in the centre, to hoist the sail before the masts, when the wind is abaft the beam.

If this form has been suggested before, I affirm that I was unacquainted with it when the design was first thought of by me. Indeed the plan is so simple, that I have no wish even to claim any merit for it.

PAUPERTAS.

SELF-ACTING BLOW-PIPE.

SIR;—I see in your Number for July 10, a description of a Self-Acting Blow-Pipe; and, as I am in the constant habit of using a common blow-pipe, and think it injurious to my health, I beg leave to make the following inquiries:—

First—Whether there is any difficulty in filling and using them to a person unacquainted with them?

Secondly—Whether there is much variation in the force the air is expelled with, from its first filling, till the air is all out?

Lastly—If the blow-pipes mounted, to be procured as directed, are expensive?

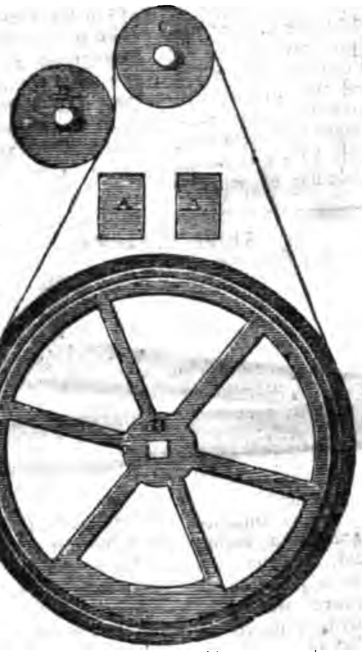
TEMPUS.

EXPEDITIOUS METHOD OF EMPTYING A FLUID OUT OF A BOTTLE.

Take a pint or quart bottle filled with water or other fluid, turn the neck downwards to empty it, and whirl it round at the same time to give the liquid a centrifugal motion; then hold it still and upright; a current of air will ascend through the centre of the neck of the bottle, and the liquid will descend around the air as quick, to appearance as if the air had access to its upper surface: fluted, square, or octagon bottles, will not answer.

J. WEBB.

IMPROVEMENT ON THE COMMON LATHE.



SIR;—In several of your Numbers are plans for improvements in the "common lathe;" their respective merits speak for themselves; but I think I have seen something similar in "The Repertory of Arts," or "The Transactions of the Society of Arts." A method of effecting the same purpose is shown by the drawing above. A A represent the beds of the lathe; B, the large wheel; C, the mandrel-pulley; D, a pulley hung in swing frame, easily contrived so as to press the band sufficiently tight, and also to be disengaged and re-engaged in an instant. I do not pretend to be "the inventor" of this method, having seen it act with the best effect some years ago in a large corn-mill, in which I was employed.

As no such plan appears in Buchanan's "Essays on Mill-Work," I presume it is not generally known.

A FRIEND.

COMMON PAPER AS STRONG AS GOLD.

SIR;—Some of your readers may not be aware that common *paper is equal in strength to gold;* but should any doubts be entertained on the subject, an easy experiment may convince any person of the fact.

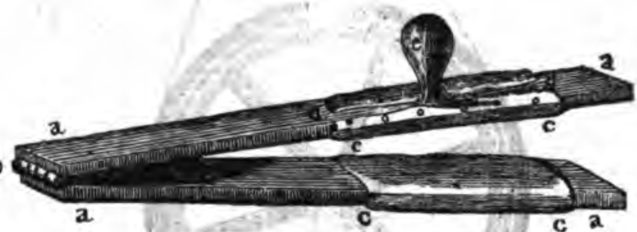
Thus, let them take half a sheet of common foolscap paper, which is about twelve inches and a half long, and eight inches wide; let this be closely rolled or folded up, making the shortest way of the paper the length of the roll. Fasten one end of this roll to a beam in such a manner as not to tear or injure the paper, and to the other end of the roll suspend a scale, and add weights till the paper is torn asunder, and it will be found, if the experiment be fairly tried, that 160 lbs. at least will be required to separate or tear the paper.

Let the paper be carefully weighed, and find how many feet in length of it will be required to make one pound in weight; multiply this number by the lbs. required to tear asunder the roll of paper, and the product will give the feet in length of its own substance, equal in weight to its cohesion, or what may be called the *modulus* of *cohesion*. Let a similar experiment be made with a piece of gold wire, and in the same manner find its modulus of cohesion, and I will venture to suppose the modulus of cohesion of paper will be greater than that of gold; or that paper, when compared by its own weight, will support more than gold.—I am, Sir,

Your's truly,

B. Bevan.

KNIFE CLEANER.



Islington.

Sir;—A clean knife is a luxury at any table, and as the following very simple application of mechanical contrivance will produce that luxury with a degree of labour incalculably less than the usual mode, I think its publication, through the medium of your interesting Magazine, will be, though a minor, yet a real benefit to the public.

a a a a are two boards, say about 20 inches long, 6 broad, and 1 thick, joined together, but not too close, at *b*, by a hinge. *c c c c* are two pieces of buff or belt-leather, stretched over the interior surfaces, and nailed on the exterior, as at *d d*; *e* is a handle to assist in holding it steady.

In using it, lay powdered Flanders' brick on the lower leather, shut the boards together, lay the left arm on the upper board holding the handle, put the knife, well wiped from grease, between the leathers, and four or five rubs *forwards* and *backwards*, not sideways, will produce a beautiful polish on both sides; the shoulders and back may be polished by rubbing on the part turned over.

A board so constructed has been used in my family for several months. I speak, therefore, not from theory, but experiment.

Your's respectfully, J. N.

MECHANICS' INSTITUTION.

A Quarterly Meeting for the discussion of business connected with this Society, was held in the chapel in Monkwell-street, on Wednesday evening. The meeting was numerous.

The first business which came before it, was a proposal on the part of the Committee, that their proceedings should be approved of, their Report received, and the Editors of the Mechanic's Magazine and the Literary Chronicle cited before the Society, to receive condign punishment for certain charges which they had dared to make against its plenipotential Committee. The labours of the Committee were, as themselves directed, approved of; and an announcement, that the new house for the Institution was to be ready in two weeks, and the lecture-room built at some future period, was received with becoming applause; but some discussion took place touching the powers of the Committee and the Institution to cite the Editors of Journals, and make them plead at their bar. *We* stayed away, not because we had made any charge against the Committee, the justice of which is not palpable to and felt by every unbiassed member of the Institution, but because our appearance at such a tribunal, upon such grounds, would have been a direct compromising of the liberty of the press—a liberty which the mechanics of England ought to be the last to infringe, and which, if allowed to exercise their own judgments, untrammelled by illiberal and designing men, we are sure they will always support. We feel towards the Institution as a parent feels towards a favourite child; for, whatever its Committees or its members may say or do, we gave the hint—we called it into existence—and but for us and our exertions, no such thing would, up to this moment, have existed. We, therefore, regard its hostility to us, its overweening attachment to those who cannot serve it, and its hankering after those who have never been known to serve any cause, as but the frowardness of a spoiled child. We trust, however, that experience will bring it back to a sense of propriety. The Institution is but a young one, and its Committee, as well as its members, seem to be but green in their duty; therefore we would wish to exercise toward them more of the kindness of a friend than of the retribution of a judge. They have done what we thought wrong; or rather, they have omitted to do what we thought right: we have told them so; they have felt angry; we pity their anger—we pray for their amendment; and so praying, we proceed to trace a line through their proceedings.

Dr. BIRKBECK (the President) stated, that the attention of the Meeting was particularly called to the concluding part of the Report—to that part which (painful as it was to the Committee) related to the charges and insinuations brought against them by the Editors of the Mechanic's Magazine and the Literary Chronicle. He wished to know whether, in consequence of notices duly served on them, those Editors (and in particular Mr. Robertson, Editor of the Mechanic's Magazine) were present to substantiate those charges and insinuations. If the Editors were not present, and prepared to justify their conduct, he would read a letter which had just been received from Mr. Robertson.

Mr. MUDIE said, that if Mr. Robertson were not present, the Committee were in possession of facts which would enable the Society to judge of the nature of the charges which had been alluded to. "Let the charges in the first place be read." If they were not read, the cause must be attributed to the circumstance that the Committee were afraid to bring those charges to light [Loud marks of disapprobation]. "If you are afraid of the truth, I will sit down" [Hear, hear! No, no!]. But the Institution was arrogating to itself a power which, thank God! the British Parliament, aye, the British Government does not assume—that of calling the Public Press before them [violent interruption]. "If, in contending for the privilege of British subjects, I am in the wrong, I will sit down" [No, no! and hisses]. The subject of complaint was, that the editors of public journals had attacked the conduct of the Committee——

The PRESIDENT here interrupted the Speaker, and said, that if Mr. Robertson were present, it would be more satisfactory to himself and to the Meeting, that he should stand up and substantiate the charges alluded to; but if he were not present, the Committee had a letter from him in their possession, which they would read.

Mr. MUDIE said, that the Committee had no power to call before it the Editor of any paper; and that if a vote to that effect were passed, it would be arrogating a power which, independent of other objections, might be dangerous to the welfare of the Institution. It was a power which neither the laws of the country nor the rules of common sense could give them [Hear, hear!].

The CHAIRMAN said, that the Committee were assuming no inquisitorial power on this occasion.

Mr. MUDIE proceeded amid continued interruptions, and maintained, that if he were set down in the summary manner which was proposed, there would be an end to all sober discussion; and that, while the privilege of speech was denied to him, the rights of the Institution were infringed, and its very existence endangered.

"The CHAIRMAN—"Hear, hear! Mr. Mudie."

Mr. MUDIE then repeated that the charges should be read.

The CHAIRMAN said, that if the Editors were not present, it would be useless to read the charges.

Mr. HODGSKIN said, that although the name of Mr. Robertson only had been alluded to in the discussion that had taken place, he thought it his duty to say that he had no hand in the charges which had been made against the Institution. And, as it might, perhaps, be known to the Members that he had been an Editor of the Magazine at its commencement, he assured the Meeting that he did not know of any of the charges *until* they had been made. Having thus cleared himself in the face of the Society from all concern in the charges, he would allude to the policy of such a discussion—a policy which could only tend to strife and discord [Hear, hear!]. He had no interest in the Institution one way or other; but he considered that they were only sowing germs which would create confusion. As the feeling of the Meeting was favourable to the Committee, he thought that they might rely on the good opinion of their constituents.

A MEMBER from the gallery moved, that the charges by Mr. Robertson be read for the information of all present.

Mr. MUDIE seconded the motion.

Another MEMBER in the gallery moved, as an amendment, that as Mr. Robertson was not present to justify the charges which he had made, the Meeting should proceed no further therein.

Mr. GILLAN deprecated the discussion of the subject altogether, considering the tone and temper of the Meeting. He contended, that the words of the Report virtually implied a censure against Mr. Robertson; and that justice could not therefore be done to him at the present time. A public Institution necessarily courted and provoked public discussion; and it were hard that an individual acting from the purest motives, should be put down in so violent and intemperate a manner.

The CHAIRMAN said, that they could not proceed to read the charges, as Mr. Robertson was not present to substantiate them.

Mr. MUDIE—"Perhaps I can do it for him."

Mr. WHITTAKER (who had previously attempted to silence this speaker, upon the ground of his not being a Member of sufficient standing to advert to the conduct of the Committee) now asked if Mr. Mudie came here as the champion of Mr. Robertson, which he could not believe, as there was a letter from that gentleman himself?

Mr. MUDIE.—"I beg leave to assure the gentleman that I am not the champion of Mr. Robertson, or of any individual; I am merely the champion of truth, common sense, and the interests of the mechanics. I speak as a mechanic, knowing something of *plugs*, and wheels, and pinions; and if the gentleman has any horror of these matters, I will not press them to the extremity of his consternation."

The CHAIRMAN.—"The Committee will not be satisfied with any proof of their misconduct, unless it come from Mr. Robertson himself."

A desultory discussion ensued, which was at last terminated by a discovery that the Meeting had, by the decision of their feet, carried the Report *in limine*; but they agreed to the amendment, that they should not exercise their inquisitorial power over the editors; and so this part of the discussion ended very nearly where it began.

The motion for the power of calling General Meetings on the requisition of 40 Members—after some discussion, in the course of which Dr. Gilchrist expressed a wish that the number had been 10—was carried by a very great majority, and passed into a law.

A motion by Dr. GILCHRIST, for empowering Members paying their annual subscription at once, to introduce a friend to the Lectures, was modified by several amendments; but the Committee having discovered that no amendment could be proposed unless hung up for the requisite time in the Secretary's room, the motion was withdrawn. After the usual complimentary votes to the Chairman and Lecturers, the Meeting then adjourned.

In the course of the evening the state of the funds was laid before the Society, along with a notice of several donations, and a hint that the number of paying members was not on the increase.

In as far as the report was intelligible, there appeared to be received in all 955*l*., of which 530*l*. had been expended, leaving a balance of 425*l*., of which 400*l*. was in the hands of Smith, Payne, and Smith. The total number of members who had paid their subscriptions, was 729; the number enrolled was about 1,000.—At the Meeting in March last, the enrolments were about 1,300, and the payments about 1,000.

Toward the close of the Meeting, a Member in the gallery suggested that the Institution should have a press of its own, to report its proceedings and Lectures, and defend the Committee against all attacks and insinuations.

The following is the letter from Mr. Robertson, alluded to by Dr. Birkbeck:—

23, Bell-street, Sept. 1, 1824.

Sir;—I have to acknowledge the receipt of your letter of yesterday's date, inclosing a copy of part of the Quarterly Report which is to be read to the Members of the "London Mechanics' Institution," at their Quarterly General Meeting this evening; in which part of the Report it is stated, that the Committee "feel themselves imperatively called upon to notice certain charges which have appeared in some recent Numbers of the Mechanic's Magazine and Literary Chronicle, which charges the Editors, who are known to be Members of this Institution, are, upon this occasion, publicly invited to stand forward, and, if possible, to justify."

The charges in the Mechanic's Magazine to which the Committee allude, were made by me, not in the capacity of a Member of the Institution, but in the distinct and separate one of an independent Journalist, entitled to express his opinion of such public men and public measures as come within the sphere to which he has devoted his attention. They were made, too, before the tribunal of the public; and it is to that tribunal alone, and not to any minor and less unprejudiced one of their own choosing, that the Committee should address any vindication which they may have to offer of their conduct.

The Committee are well aware, that the same pages in which their proceedings have been arraigned, have been always open to any defence they may choose to make; and as I cannot, for the reason just stated, accept *their* invitation to a personal altercation, I hope they will accept of *mine*, to make as free a use as they please of the medium which the Mechanic's Magazine affords them of vindicating themselves from the charges which it has disseminated against them.

The charges, besides, *require no justification*; for they are already so full and explicit as to leave nothing to be added or supplied; they require only to be answered, and, if possible, refuted. Could I have accepted of the invitation of the Committee, it would have been but to repeat those statements and opinions which have lain for weeks before them unanswered and unrefuted.

It is very possible that the Members at large may think differently from me of the conduct of their Managers; and, considering the extreme willingness which they have all along manifested to think and hope the best, I look upon it as even probable that they may on this occasion be persuaded into a resolution that shall acquit the Committee of all blame. I think, however, that I am entitled to ask of my fellow-members that they will grant me the same freedom of judgment which they claim for themselves, and that they will not imagine that because I happen to differ from them in opinion, I must be guided by motives less pure and honourable than their own.

"I can unfeignedly assure them, that in all I have said or done, the good of the Institution has been, as it ever will be, uppermost in my thoughts. My hope still is, that under better management, it will become all that its best friends can wish; and when the day arrives that I can as honestly exult in its success as I have honestly lamented the little progress which I conceive it has hitherto made, it will be to me a day of as sincere pleasure as I have ever known.

I am, Sir,
Your obedient servant,
J. C. ROBERTSON.

To Mr. Flather,
Secretary to the London Mechanics' Institution.

GUNTER'S LINES.

Sir;—When I began to study practical mathematics, I was almost as much perplexed as your correspondent "Unit," with the very useful Gunter's Lines. There is no book that I have met with which treats properly of their *description*. The Encyclopædias mostly copy one from the other. Those books which prescribe the rules of application in resolving numeral questions by the lines, do not treat of their *description*; and those which contain the mathematical elements, are remarkably silent on most matters of practice. I have not yet seen Gunter's own book "De Sectore et Radio," and know of no other publication in which it is likely for "Unit" to gain a full insight into the construction of the lines. Perhaps, therefore, you will allow me to give him such information as I have been able to collect, referring him for the best description I know of, to Adams' published Geometrical Essays. He will learn there, that the lines of the sector are of two sorts, which we may properly style natural and artificial lines; the first being natural lines, chords, sines, &c., with the lines divided decimally, and the circular parts into degrees and half degrees: the artificial lines are logarithmic. Turning to Hutton's Mathematical Tables, preface, p. 35, we find that, "In 1623 also, Gunter applied the logarithms of numbers, sines, tangents, &c. to straight lines drawn on a ruler, with which, proportions in common numbers and trigonometry were resolved by the mere application of a pair of compasses—a method founded on this property, that the logarithms of the terms of equal ratios are equi-different." Now, the common log. of 10 is unity, or 1, and the log. of 1 = 0. If, therefore we take a given line for the log. of 10, the log. of the remaining digits of the scale are to be found in this line; and all that is required is to divide it so that its several parts shall bear the same proportion to the whole, as the log. of the several natural numbers bear to 1, the log. of 10. Let our given line be 7 inches; we want to divide this logarithmically, and first to cut from it a part which may represent the log. 2. In the table we find this log. expressed in numbers to three places of decimals, by 0·301; and ·301 of 7 inches = 2·107 inches = the part required, and similarly for the other logarithms. Let your correspondent now take his sector and compasses; let him take the space between the beginning of the scale and the number 2; turning over the compasses, he will find their other foot upon 4; turning over again, he will come to 8, once more to 16, and so on. Having the same distance in his compasses, let him set one foot upon 3, the other foot will stand upon 6; the next turn will place it at 12, &c. And if he now looks into his logarithmic tables, he will find the log. 4 = 2 log 2; log. 8 = log. 4 + log. 2, &c.; log. 6 = log. 3 + log. 2; log. 12 = log. 6 + log. 2, &c.—A word to the wise. Your correspondent will now, without much difficulty, find out all the mystery of all sorts of logarithmic lines. I have only to state further, that the explanation he quotes from the Encyclopædia is palpably incorrect. It confounds together the line of sines marked L on the sectors, and the line of numbers marked N. He must, besides, permit me to observe that there is no royal road to knowledge. If he seeks for pleasure in scientific pursuits, he must resolve to toil both with head and hand. "Nil sine magno labore Deus mortalibus dedit," says the Roman. "Precept upon precept, and LINE UPON LINE," says Solomon. "Get wisdom, and with all thy getting, get understanding," says the same wise man; and perhaps "Unit" may find it worth while to apply all these sayings to his own case.—I am, Sir,

Your obedient servant,

MONAD.

TABLE OF CANDLE-LIGHT.

For Mean Time for the third Quarter of 1824.

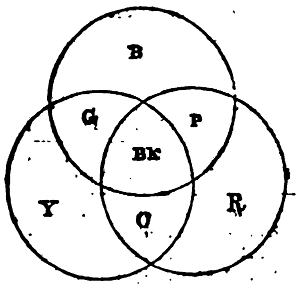
BY B. BEVAN, ESQ.

(Continued from p. 108.)

DAY.	JULY.		AUGUST.		SEPTEMBER.	
	End, Morning.	Begin, Evening.	End, Morning.	Begin, Evening.	End, Morning.	Begin, Evening.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	3.. 3	9.. 3	3..45	8..27	4..40	7..20
2	3.. 4	9.. 3	3..47	8..25	4..42	7..18
3	3.. 5	9.. 3	3..48	8..24	4..43	7..16
4	3.. 6	9.. 2	3..51	8..21	4..45	7..13
5	3.. 7	9.. 2	3..53	8..19	4..47	7..11
6	3.. 8	9.. 0	3..54	8..18	4..49	7.. 7
7	3.. 9	9.. 0	3..55	8..15	4..51	7.. 5
8	3..10	8..59	3..57	8..13	4..53	7.. 3
9	3..11	8..59	3..59	8..11	4..54	7.. 0
10	3..12	8..58	4.. 1	8.. 9	4..56	6..58
11	3..13	8..57	4.. 3	8.. 7	4..58	6..56
12	3..15	8..55	4.. 5	8.. 5	4..59	6..53
13	3..16	8..54	4.. 7	8.. 3	5.. 0	6..52
14	3..17	8..53	4.. 8	8.. 0	5.. 2	6..50
15	3..18	8..52	4..10	7..58	5.. 3	6..47
16	3..20	8..51	4..12	7..56	5.. 5	6..45
17	3..22	8..50	4..14	7..54	5.. 7	6..43
18	3..23	8..49	4..16	7..52	5.. 8	6..40
19	3..25	8..47	4..17	7..49	5..10	6..38
20	3..27	8..45	4..19	7..49	5..12	6..36
21	3..28	8..44	4..21	7..46	5..13	6..33
22	3..30	8..42	4..23	7..43	5..15	6..31
23	3..32	8..40	4..25	7..41	5..16	6..28
24	3..33	8..39	4..26	7..38	5..18	6..26
25	3..34	8..38	4..28	7..36	5..20	6..24
26	3..36	8..36	4..30	7..34	5..22	6..20
27	3..37	8..35	4..31	7..31	5..24	6..18
28	3..38	8..34	4..34	7..28	5..26	6..16
29	3..40	8..32	4..36	7..26	5..28	6..13
30	3..42	8..30	4..37	7..25	5..29	6..11
31	3..44	8..28	4..38	7..22	——	——

PRIMITIVE COLOURS.

Sir;—In confirmation of the observations of "Brush," on primitive colours (p. 57, Vol. II.), I beg leave to send you an extract from "Hayter's Introduction to Perspective Drawing and Painting," one of the most practically useful books on these branches of art with which I am acquainted.—Your's, Pallet.



"You may try another experiment in proof of the primitive superiority of red, yellow, and blue, over all other colours [see the prefixed diagram: this scheme is my own]. First draw a circle; then, with the same opening of the compasses, set one foot on the circumferent line, and draw a second circle; and again, with one foot of the compasses on the point where the two circles bisect, draw a third; cover one whole circle with yellow, another with red, and another with blue (letting each dry before you lay the next); the colours intermixing by the equilateral intersection of the three circles, will produce green, orange, and purple; and the central portion, taking all the three colours, will be neutral of the black class, and nearly black, according to the strength of the three separate lays of the primitive colours. By this diagram you will have a certain proof of the colours which are most adapted to oppose each other, from which the knowledge of their harmonizing properties may be derived. You will find a primitive colour always opposite to a compound one; as, blue will be opposite *orange*, red opposite *green*, and yellow opposite *purple*; which must determine them to be the natural opposites: this is highly useful for a painter to understand."

[The different colours are denoted in the diagram by the initial letters Y G B, &c.—Edit.]

CAOUTCHOUC AND BIRD-LIME.

Sir;—Having seen, at p. 364, Vol. II., of your widely circulated Magazine, a paper on caoutchouc, I thought some of your numerous readers might be unacquainted with the close analogy existing between that substance and bird-lime. When pure, they are both without taste or smell, extremely adhesive, and insoluble in water or alcohol, but both soluble in volatile oils and æther. They are both affected by the strong acids in the same manner: sulphuric acid turns them black; with nitric acid they yield oxalic acid, and neither of them is affected by muriatic acid; they both burn with a bright flame, emitting a fœtid smell during combustion; their chemical composition is precisely the same, viz. carbon, hydrogen, azote, and oxygen. The only important difference appears to be this: caoutchouc, by absorbing oxygen from the air, obtains a considerable degree of hardness; whereas bird-lime, when exposed to the air, remains unaltered in its original viscid state. Now, as it also is soluble in petroleum, or naphtha, would it not form a much easier and cheaper solution for making cloth water-proof, and save the South Americans the trouble of bottling the liquid caoutchouc? It appears to be a desideratum worthy the endeavours of the chemist, to find some method of imparting to bird-lime the hardness of Indian-rubber, that it may be applied to the various purposes for which that is now used.—Your's, &c.

E. Lessur.

SINGULAR PROPERTY OF SILVER.

August 26, 1824.

Sir;—I have often observed, that if a piece of silver, in the shape of a ridge tile, be made red hot, and placed with its concave face undermost, on a round-faced anvil, it will begin slowly to vibrate; and that the vibrations increase in velocity for several minutes, and afterwards decrease in the same ratio till they subside. A piece of silver 9 inches long, and 7 $\frac{1}{16}$ wide, with a curve 2 inches in depth, will vibrate 9 minutes, with very irregular motion. A piece in length 8 inches, in width

4 ½, thickness ¼ inch, curve 2, will vibrate 8 minutes. A piece 5 inches in length, 4 in width, ¼ inch in thickness, with little or no curve, will vibrate three times as fast as either of the others.

"Iron, brass, and gilding metal of the same shape, do not vibrate under the same circumstances. I shall be obliged to some brother mechanic to explain the cause of this vibration.—Your's, &c.

BEAR AND RAGGED STAFF.

ANSWERS TO INQUIRIES.

No. 50.—BORING FOR WATER ON DENMARK HILL.

If the inquirer had stated to what height the water rises in the wells at Denmark Hill, it would have been more easy to say whether boring would be attended with success or not. If in sinking a well of 150 feet, the water rises to within 20 feet of the surface, which is sometimes the case, a great expense might have been saved by boring; for if the well had been sunk 25 feet, and the remaining 125 feet had been bored, the water would have risen to the same height, and there would have thus been a constant supply of 5 feet water in the well. But if the water rises only a few feet in the well, then no advantage will be gained by boring; for it is an erroneous opinion, that water will rise higher by boring than by the common method of well-sinking.

HYDRAULICUS.

INQUIRIES.

No. 64.—REFLECTING TELESCOPES.

"What are the obstacles to the formation of reflecting telescopes" for astronomical purposes, of infinitely greater power than any that have yet been used? The late experiments upon the alloys of steel, carried on at the Royal Institution, seem to indicate that there are compounds better fitted for the formation of speculums than those at present in use; and it appears to me probable, that future experiments upon metallic alleys may produce a compound of a more susceptible homogenous surface than any hitherto discovered, and capable of being manufactured into speculums of any required size. I am, however ignorant whether, even if this difficulty were overcome, there would not remain many others to prevent the attainment of an object so interesting to the science of astronomy as the increased power of the telescope; and shall be much gratified, if, through the medium of your work, I can be informed of the various obstacles that oppose our progress in this department of science and art.

I am, Sir,

Your most obedient servant,

AMATEUR.

NEW PAPER.

A new paper is stated to have been invented in France, which is made of a composition that resembles a preparation of the finest quality of rags, and is readily converted into a pulp, without the employment of any kind of machinery. The material, it seems, can be provided at so cheap a rate, that it is estimated its whole cost, including the expense of manufacture, will be less than sixpence per pound. The inventor, however, keeps the nature of the composition a secret, and the merits of it are as yet all matter of assertion.

INODOROUS HYDROGEN GAS.

When hydrogen gas, obtained from a mixture of iron filings and diluted sulphuric acid, is passed through pure alcohol, the hydrogen loses its odour in a great measure; and if water be added to the alcohol, it becomes milky; if inclosed in a flask, and left for some days, an odorous volatile oil is deposited, which was contained in the gas, and which contributed to its well-known odour. Perfectly inodorous hydrogen gas may be obtained by putting an amalgam of potassium and mercury into pure distilled water; but if an acid or muriate of ammonia be added to the water, which accelerates the development of the gas, it gives the same odour as that remarked in the solution of zinc by weak sulphuric acid. This odour, therefore, does not belong to the hydrogen gas, but arises from the mixture of impurities. BERZELIUS.

MINERAL TALLOW.

This rare substance, which was first discovered in Finland, in 1736, has lately been found in a bog on the borders of Loch-Fyne, in Scotland. It has the colour and feel of tallow, and is tasteless. It melts at 118°, and boils at 290°; when melted, it is transparent and colourless; on cooling, becomes spongy and white, though not so much so as at first. It is insoluble in water, but soluble in alcohol, oil of turpentine, olive oil, and naphtha, while these liquids are hot; but it is precipitated again when they cool. Its specific gravity, in its natural state, is 0·6078, but the tallow is full of air-bubbles; and after fusion, which disengages the air, the specific gravity is 0·983, which is rather higher than that of tallow. It does not combine with alkalies, nor form soap. Thus it differs from every class of bodies known—from the fixed oils in not forming soap, and from the volatile oils and bitumens in being tasteless and destitute of smell. Its volatility and combustibility are equal to those of any volatile oil or naphtha. — *Edin. Phil. Jour.*

NEW PATENTS.

To Edward Cartwright, of Brewer-street, Golden Square, Westminster, engraver and printer; for his improvements on, or additions to roller printing presses.—July 27—2 months.

To John Price, of Stroud, Gloucestershire, engineer; for certain improvements in the construction of spinning machines.—August 5—6 months.

To George Graydon, of Bath, esq. captain of the royal engineers; for his compass for navigation and other purposes.—August 5—6 months.

To Jacob Perkins, of Fleet-street, London, engineer; for certain improvements in propelling vessels.—August 9—6 months.

To Herman Schroder, of Hackney, Middlesex, broker; for a new tiller.—August 11—6 months.

TO CORRESPONDENTS.

The conclusion of the notice of Mr. Stuart's Descriptive History of the Steam-Engine is unavoidably deferred till our next.

T. M. B. will please refer again to what we did say. We did not say that the insinuations we had advanced "should be in a fortnight substantiated," but that we were "fully prepared to substantiate" them, "*when the proper occasion arrives.*" The proper occasion, we think, will be when the Committee of Managers declare, on their honour and honesty, that there was no foundation for them. Four weeks have they had to say so, and still they are silent. The insinuations to which our correspondent alludes, are, we presume, those contained in the 2nd paragraph, 1st col. p. 324, Vol. II.

T. M. B.'s letter on the other branch of the subject furnishes nothing new,—only an unfortunate reference to the London Institution. Dr. Birkbeck's Lectures to the London *Gentleman's* Institution, are styled in the advertisements of that establishment, *honorary*; the same lectures, when delivered at the London *Mechanics'* Institution, are called *gratuitous*. Is there a mechanic of so mean a spirit as not to perceive and feel the distinction?

A Subscriber—we shall inquire.

John Barton—in our next.

The papers of J. H. and G. C. have been overlooked; they shall have an early place.

Communications received from N. B. —T. G. D.—A.—J. Y.—A Constant Reader—G. J. N.—M. A.—Secker—J. E. Coombes—P. Vanryde—T. P. A —W. H. D.—An Old Carpenter (who regrets that Mr. Horsfall should have left the subject of the Raised Roof with so little explanation)—A Youthful Mechanic—A Dabbler—Chelmsford Provident Society—Chemicus—L. D. — Gilpin—W. H——s—A Mill-Maker—Messrs. Scheelings and Co.—Mr. Wills—An Inquirer —An Old China Fancier—Secretary of the Chemical Society (which we congratulate on its establishment)—Mr. Brown — Nrubkcalb Caasi — G. L. — Wm. Andrews—D. Screw—Mary M., Westminster—Aurum — Robert Parkinson — B. N.—A Norfolk Farmer—A Young Glazier—Froxfieldiensis—Joseph Hall—William Tonkin—J. Y.—C. B— Elucidator—Bullet and Shot—Tyro.

G. A. S. and J. W. are requested to send to our Publishers for letters addressed to them.

ERRATA IN LAST ARTICLE ON "MECHANICAL GEOMETRY."

P. 376, col. 2, last line, *for* D C *read* B C; p. 377, 1st col. 3rd line from top, *for* larger *read* longer; *ibid.* 5th line, *for* A D and D C *read* A B and D C.

Communications (post paid) to be addressed to the Editors, at

THE PUBLISHERS,

KNIGHT AND LACEY,

55, *Pater-noster-Row, London.*

T. C. Hansard, Pater-noster-row Press.

Mechanic's Magazine,

Museum, Register, Journal, & Gazette

"The most valuable gift which the Hand of Science has ever yet offered to the Artizan."—*Dr. Birkbeck.*

.... The man who consecrates his hours
By vigorous effort, and an honest aim,
At once he draws the sting of life and death;
He walks with Nature, and her paths are peace.—*Young.*

No. 55.] SATURDAY, SEPTEMBER 11, 1824. [Price 3d.

WIRE GAUGE.

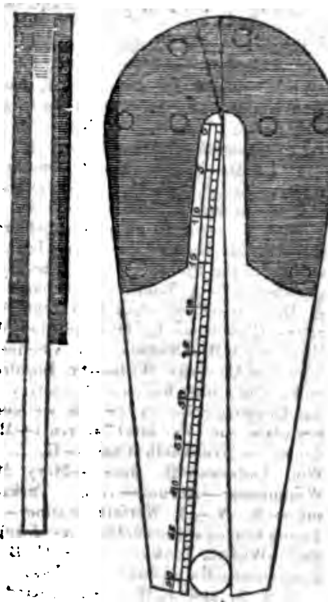


Fig. 2.

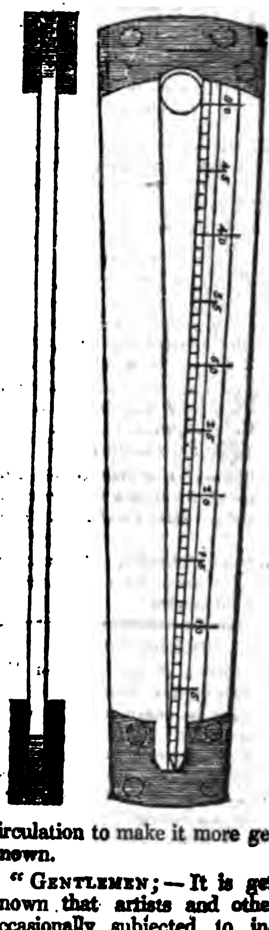


Fig. 1

The following description of an improved "Wire Gauge" has been communicated to the Society for Promoting the Useful Arts in Scotland, and by them printed for distribution. We gladly lend the aid of our extensive circulation to make it more generally known.

"Gentlemen;—It is generally known that artists and others are occasionally subjected to inconvenience and uncertainty from the disagreement of the common wire gauges, the scales of which are not formed on any certain principle, and whose numbers have no rational connection with the sizes they denote.

"In the gauge most generally used, wire of about ·31 hundredths of an inch diameter, is called No. 1, and the sizes decrease to No. 26, which is under ·02 hundredths. Some classes of artists use gauges in which No. 1 denotes the smallest size, the dimensions increasing with the numbers. In the first case, wire thicker than No. 1, can have no name; and in the latter case, the reverse obtains. In both cases, it is found in practice, that corresponding numbers in gauges (which profess to be similar) often differ very materially; and an artist who may order wire from the manufacturer by a No. is liable to find that the gauge used by the latter, may differ a size or more from his own.

"With a view to do away these inconveniences, and to obtain some advantages, it is respectfully proposed to the Society to sanction, by their recommendation, the establishment of such *a standard gauge as may be easily and accurately made by any tolerable workman, of which all copies must tally with one another, and in which the numbers may denote the actual diameters of the wire.*

"To fulfil these conditions, all that is required, is to take two straight rulers (of any convenient length), to make their edges touch at the one end, and to separate them *near* the other by a cylindrical or spherical body, of half an inch diameter. If the rulers be unalterably fixed in this position, and the space lying between the points of contact with the cylinder at the one end, and of the rulers at the other, be divided into 50 equal parts, and numbered from 50 down to 0, then the divisions will show the diameters of wire in hundredths of an inch. If the dispart, instead of being made ·50, is made ·05 hundredths, then the divisions would show thousandths, which would make a convenient gauge where fine wire should be most used.

"The three faces of the rulers which remain unoccupied by the standard scale, may be furnished with divisions and numbers, formed from any of the gauges at present in use, which would enable artists to ascertain sizes, according to both the present and the proposed scales at the same time.

"Along with this, I have the honour of submitting to the inspection of the Society, a gauge made on this principle of two steel rulers, riveted at the ends to clips of brass; also a drawing of some different forms which may be given to the instrument.

"Fig. 1 is similar to the instrument presented.

"Fig. 2 is adapted to gauge wire in bundles, when the ends are inaccessible.

"Fig. 3* is a compact form, adapted to sizing drills, &c.

"I have the honour to be, &c. &c

"To the Society for Promoting the Useful Arts in Scotland."

"P. S.—It will occur to every intelligent workman, that the dispart at ·50 should be made by the actual insertion of a cylindrical body, and not by compasses, as a small variation in the width must take place, according to the length, and angle of inclination of the rulers."

STUART'S DESCRIPTIVE HISTORY OF THE STEAM-ENGINE.

(Concluded from p. 394)

In 1804, Messrs. Vivian and Trevithick accomplished what was first suggested, as far back as 1759, by Dr. Robison — the application of steam-power to the moving of carriages. At Merthyr Tydvil, in South Wales, a locomotive steam-engine was brought into use, which drew as many carriages as contained about ten tons and a half of iron, travelling at the rate of five miles and a half an hour, for a distance of nine miles, without any additional water being required during the time of its journey. Its cylinder was eight inches diameter, and the piston had a four-feet stroke. The same engine employed to raise water, worked a pump of 18½ inches in diameter, and a

* In our engraving, it is the figure not numbered.

stroke of 4½ feet, raising it 28 feet high, and making 18 strokes in a minute. It used eighty pounds weight of coal per hour, and in the same time it raised 15,875,160 lbs. weight of water one foot high, the pressure being 65 lbs. on each square inch of the piston. This engine is at once most compact and simple in its operation. "Steam is admitted from the boiler under a piston, moving in a cylinder which impels it upward; when it has reached this limit, the communication between the piston and under-side of the piston, is shut off, and the steam which has raised the piston, is allowed to escape into the atmosphere; a passage is opened between the boiler and the upper-side of the piston, which is then pressed downwards, and the steam is again allowed to escape into the atmosphere." Its power, of course, is equal to the difference between the pressure of the atmosphere and the elasticity of the steam.

The mechanism for insuring the safety of Vivian and Trevithick's engine, is similar to that in use for condensing engines. It consists of a safety-valve, loaded with a weight equal to the pressure the apparatus can sustain; a plug of lead or other metal inserted into the side of the boiler, which will melt when the water in that vessel is heated to a certain point, or when it may have fallen below the assigned level; and a mercurial syphon, of a length proportioned to the pressure. By means of these contrivances, and an ordinary share of care and attention, Mr. Stuart thinks that the security of high-pressure is equal to that of low-pressure boilers.

We are not, as yet, in possession of any accurate experiments from which the gain in power of this engine may be exactly stated; but the usual performance of Trevithick's engine may be taken equal to four-fifths more than the average performance of the condensing engines with the same quantity of coal.

Mr. Stuart states, that "all the American boats (except one or two) are propelled by high-pressure engines, in many cases working at double the elasticity recommended by Trevithick." This is one of the very few erroneous statements in the work. The fact is precisely the reverse: there are only two or three (since the explosion of the Etna, we believe *but two*) American steam-boats propelled on the high-pressure system. "Vulgar prejudice" on the subject is just as strong in America as it is here: the common condensing engine is generally preferred; and the Americans remain yet to be persuaded of the truth of Mr. Stuart's remark, "that high-pressure ones are equally safe, and more convenient from their portability, and the great facility they offer of adjusting the power to the resistance, in cases where the work or load may be variable."

Steam of a high temperature was applied in a somewhat different manner, by Mr. Arthur Woolfe, in 1804. He proposed an engine with two cylinders, to be proportioned to each other, according to the elasticity of the steam to be introduced into them; to allow, for example, an expansion of from six to nine times. He makes use of a boiler similar in principle to that which was attached to Blakey's engine. He introduces the water into a collection of pipes, placed in a furnace, and connects them with a cylindrical vessel of a larger diameter, which is attached by the pipe to the steam-cylinder. Water is forced into this large vessel by a pump, and the whole arrangement of the fire-place and boiler is extremely favourable for procuring the greatest quantity of heat from the fuel. It appears, from published accounts of the average performance of several of the Cornwall engines, that a considerable saving of fuel arises from using the second cylinder."

On advancing to the consideration of Mr. Perkins's engine, Mr. Stuart refers his readers for "a good engraving of the apparatus, and a very minute detail to the third and sixth Numbers of that useful miscellany the Mechanic's Magazine."

Mr. Stuart remarks of Mr. Perkins, that "he has, properly speaking, made no improvement on the steam-engine; for his experimental model was the same in all its details with the Watt engine; neither is using steam of a prodigious elasticity at all a novelty in steam apparatus. The fact also of water being capable of having its temperature raised under pressure had long been known; but the method of heating the water subjected to this pressure, and the simple and effective manner of producing and continuing it, may possibly yet rank among the most important inventions of the time."

We here close our notice of Mr. Stuart's interesting volume, recommending it earnestly to the perusal of all who are desirous of possessing, at little cost, a full and accurate history of what, next to printing, is by far the most important invention of modern times.

CUTTING HARD STEEL BY SOFT IRON.

In an early Number of our work (p. 109, vol. 1), we quoted from Professor Silliman's American Journal of Science and Art, an article in which the fact, that soft iron in rapid revolution will cut the hardest steel, was treated as a novel discovery of great singularity. Almost immediately after, we were favoured with a communication from an intelligent working mechanic, in which he showed (p. 149, vol. 1), that this *novel* discovery was as old as the days of Tubal Cain, at least, and had long been familiar to practical men. For several months this statement has been before the public, and yet we find that nearly all the *Scientific* Journals (as they are called) of the past month, have busied themselves in copying from the same Professor Silliman's Journal what is entitled, "Further Information" on the subject, of which information a leading feature is, that the fact was "*not before known to practical men*"!!! Professor Silliman, who, on the other side of the Atlantic, might not possibly have seen our young work at the time he wrote this "further information," may be excused for overlooking what *practical men* in "the old country" say of the matter; but, that our philosophers at home, who have seen our work, and who do see it regularly, should affect such disregard to what it tells them on the best practical authority, is somewhat surprising. We subjoin the whole of this article of "further information;" for though of little real value, it furnishes an amusing specimen of what may be justly termed the conceit of learned ignorance.

"The remarkable fact, that *soft iron, in rapid revolution, will cut the hardest steel*, was first described by the Rev. Herman Daggett. *This fact does not appear, as far as I am informed, in books; nor have I found that it was before known to practical men.* It seems to have been discovered by the *Shakers*,* who are remarkable for the neatness and expertness of their mechanical operations. As it is desirable that the experience of others on this subject should be made known, I will now add, that in June (1823) I saw Professor Robert Hare, at Philadelphia, execute, with a common foot-lathe, operations similar to those described by Mr. Daggett: they were, however, less energetic and decisive; as the machine did not produce so rapid a motion as that of Mr. Barnes.

"I have, however, since repeatedly seen the experiment succeed, in the most perfect manner, at the manufactory of arms, belonging to Eli Whitney, esq. near this town [New Haven, Connecticut]. As water-power is here applied with great facility and energy, a wheel of soft and very thin plate iron, six inches diameter, and mounted upon an axis, was made to revolve with such rapidity, that its motion became entirely imperceptible, and the wheel appeared as if at rest. When pieces of the best and hardest steel, such as files, and the steel of which the parts of gun-locks are made, were held against the edge of the revolving soft-iron plate, they were immediately cut by it, with a degree of rapidity which was always considerable, but which was greater, as the pieces of steel were thinner: pieces, as thick as the plate of *a common joiner's saw, were cut almost as rapidly as wood is cut by the saw itself!*

"Considered as an experiment merely, this is a very beautiful one, and in no degree exaggerated, in Mr. Daggett's account: there is a very vivid coruscation of sparks, flying off in the direction

* A religious sect in the United States.

of tangets to the periphery of the cutting-wheel: an intense ignition of the steel, extending for a considerable distance a-head of the section, and on its sides, attends the operation. The impulse against the steel is so strong, that, in several instances, it was thrown against the opposite side of the room, with a velocity that might not have been without danger to a person standing in the way.

"*It may be said, I believe with safety, that none of the ordinary operations, commenced upon cold and hard steel, will divide it with so much rapidity as this mode of applying soft iron.*

"After all, it is evident that it is only a peculiar method of cutting red-hot, or, possibly, white-hot steel; for the mechanical force produces these degrees of heat; and it is one of the best methods of evolving heat, by mechanical impulse.

"The steel, of course, loses its temper at the place of section, and there only; for the softening extends but a little way, and is limited to a narrow portion, marked by the iris colours known to be produced by heat upon steel.

"The iron plate, as Mr. Daggett states, becomes only warm, and wears away only very slowly: yet it does wear; for the edges are left rough; and the channel of section in the steel exhibits, with a magnifier, minute striæ, or grooves, running in the direction of the wheel's revolution. I know not that there is any reason to suppose any peculiar electrical phenomenon to be produced; except, that electricity always accompanies heat.

"It is plain, from the important use made of this method of cutting steel, by the Shakers, and Mr. Barnes, that it may be of considerable practical importance.

"As a philosophical experiment, it is highly interesting; and it remains yet to be shown, why the heat evolved by the impulse should nearly all be concentrated in the steel, and be scarcely perceptible in the iron: neither is it perfectly clear, why even ignited steel should be so easily cut by the impinging of soft iron. *No smith, probably, ever thought of attempting to divide steel by applying an iron tool.*"

HARD AND SOFT SOLDERS FOR COPPER AND BRASS.

The following particulars we extract from the *Dictionnaire Technologique*, a valuable French work:—

SOLDERS FOR COPPER.

"There are two kinds of these solders; the one for *hard*, and the other for *soft* soldering. The *hard solder* is made with eight parts of copper and one of zinc, the copper being first melted in a crucible, during which operation, the zinc is also heated. When the copper is melted, the zinc is thrown hot into it: the crucible is then covered, and the whole well shaken together. In about two minutes, the metal is poured out, through the twigs of a birch-broom placed over a proper vessel filled with water. The metal is, by this process, divided into small grains; after which, it is well washed, and kept for use. This solder is very fusible, and at the same time malleable.

"An alloy, composed of three parts of copper and one of zinc, also makes a good solder.

"In general, the solder is harder or softer, in proportion to the quantity of copper employed. The more copper is used, the harder is the solder, but less fusible. The highest degree of hardness is produced when 10 parts of copper are united with one part zinc; but this is also the least fusible. Solders of different degrees of fusibility are often required, particularly in cases where several pieces are to be soldered one to the other. The *least fusible* solder is employed in the first place; and the other degrees in proportion to the number of pieces to be soldered. By adopting this precaution, the first soldered pieces are not affected by the degree of heat necessary for joining the other pieces.

"*Soft solder* is a mixture of two parts of tin and one of lead, poured into ingot moulds. It is used with a hot iron, as the plumbers and tinmen use it."

SOLDERS FOR BRASS.

"Two kinds of these solders are also employed; the *hard* and the *soft*. The hard is made in the same manner as that for copper, but of brass and zinc; and the proportions may be varied from 16 parts of brass and one of zinc, to two parts of brass and one of zinc.

"The *soft solder* is made of six parts of brass, one of zinc, and one of tin. The brass is first melted; the tin is then added; and, lastly, the zinc; which last metal should be first well heated. The whole is then agitated, and divided into grains, by the process above explained.

"It is always necessary, before soldering, to clean the surfaces well, which are to be soldered, either with a file, a scraper, &c."

INDEPENDENT EDUCATION.

We have read with much pleasure in the John Bull Magazine, the following enlightened and sound observations on the subject of gratuitous or eleemosynary education. The paper from which they are extracted, is signed "A Mechanic of Fleet-street," and the Editor states, that with a few alterations in orthography, and one or two of style, as it appears it came from the author. Would that such sentiments as those which it contains were more prevalent among the working classes! We agree with our brother editor, in thinking that the effect would be to raise them above what they have been but "too long made by those who care nothing whatever for their real interests... What that has been, we can tell them in a word with which they are very familiar—they have been, on all occasions, made neither more nor less than *tools*."

"But while advocating the cause of education in general, it is necessary to obviate the effects of a too ardent philanthropy, which would spoil by forcing that which would grow and flourish of its own accord. Many worthy individuals, fully convinced of the advantages of education, wish to make it general by eleemosynary encouragement. This, for several reasons, is impolitic. In the case of a parish pauper, we should certainly instruct him on the same principle that we would clothe him; because, if it is not done at the public expense, it will not be done at all; but, upon the same principle, it would be just as proper to clothe as to educate the son of a mechanic, who can afford to do so at his own expense; for what he gets without paying for, he will neither value so highly, nor use to such advantage.

"Let us add, that the habit of receiving charity destroys that spirit of independence which is so essential to the character of the subject of a free country; and damps the feeling of reliance upon one's own exertions, which is indispensable in making a man turn his talents to the best account for his own benefit; and, consequently, for the benefit of the community to which he belongs.

"Again, we deny the propriety of forcing education by artificial means, upon the same principle that we object to forcing the production of any other commodity: first, because more may be produced than there is a demand for; secondly, because what is produced will be of inferior quality; and thirdly, because, like every thing else that is forced, it will be liable to continual interruptions and fluctuations, and will end in a series of jobs for the benefit of private individuals. Need we say that in this latter case the public interest will be gradually lost sight of, until at length it is totally neglected?

"As for the first of these objections, it is universally admitted, then, that education is an essential benefit, or even necessary, to the community at large—so is food—so are clothes: why not, then, give a fair and just price for what is necessary, to a comfortable existence? If the people are of opinion that other things contribute more to their comfort than the education of their children, let them be convinced of their error, by seeing the beneficial effects of education on the children of their neighbours; and not force instruction down their throats, any more than you would feed the family of a man, to enable him to spend the money that ought to be employed for that purpose, at the ale-house. This is not charity, but the abuse of it; for by this you encourage education at the expense of the greatest end of education—morality; and the child so educated will, when he becomes a father, expect a similar boon from charity, or will neglect his children as his father neglected him.

Our second position is so obvious, that it may be dismissed by asking this very simple question: Is it possible, in the nature of things, that the pensioned schoolmaster, whose livelihood is quite independent of his exertions, will take the same pains as the man whose existence depends on the proficiency of his pupils? If any one thinks so, let him look to free-schools wherever they exist, and without going out of the empire, the history of those of the sister-kingdom will fully demonstrate, that such must, in the course of time, degenerate into jobs: indeed, for that matter, we might, if we liked, look nearer home.

What, then, is to be done? Is the education of the poor to be neglected, or, what amounts to the same thing, to be left entirely to chance and their own exertions? We say by no means. Let education be placed within their reach by economy of their slender means. We know that by a strict attention to this, children can be educated in the country, giving a sufficient income to the schoolmaster, and paying for all the materials that he requires, at the rate of about 6*s*. 8*d*. per scholar per annum; that is at an average, instructing a child in reading, writing, and the practical rules of arithmetic, which it has been possible to do on an average of three years' tuition, for the sum of 1*l*. sterling. But suppose, that in the metropolis and other large towns, that sum should require to be doubled, is there any of the working classes who can earn their bread, who cannot pay 3½*d*. per week for the education of each of their children? Yet, for this sum, we know that a much better education than falls to the lot of many, even of the middling classes, could be conferred.

There is only one more argument which of late has come into vogue against encouraging education among the lower orders, which we think it necessary to refute before concluding. It is said, if you educate every one, where is the advantage of the middle classes over the lower, in being able to educate their children? By diffusing education among children of an inferior rank, you are taking the bread from your own children, and giving it to those of others. Allowing this to be true, the motive for withholding a benefit from others is too selfish for a generous mind to listen to for a moment. But luckily, like most arguments against the amelioration of the human race, it is futile. Every discovery and improvement in mechanics gives employment to hundreds of all classes of the community. The more you add to the power of a nation, the more you enrich her, and every individual she contains. James Watt, the son of a schoolmaster, in an obscure village, has done more real good to the people of Great Britain than all the statesmen she has produced since the Revolution. The more widely you diffuse education by fair and honourable means, the greater is your chance of bringing forward such men, and of increasing the wealth, the power, and the happiness of the people.

ANOTHER IMPROVED CLOCK.

Slaithwaite, near Huddersfield, Aug. 7, 1824.

Sir;—In your valuable Magazine (No. 45), I see an account of a clock by Mr. Collins, which shows hours, minutes, and seconds, with three wheels, and I suppose two pinions, though he does not mention them.

I beg leave to inform you, that I constructed a clock in the same year that he mentions, which shows more with three wheels and two pinions than any one that I have seen or been informed of. My hour and minute hands both revolve round the same center, and the seconds hand revolves in the arch above, and all go the right way round; so that its outward appearance is perfectly plain to the meanest capacity—the same as any common eight-day clock. It also shows, through apertures in the face, the day of the month, the age, and phases of the moon. I can turn the hands all together, either backward or forward, without trouble; but the clock very rarely requires it, as it keeps very good time—much better than any common clock that I know of. It goes eight days, and does not, like other common eight-day clocks, stand during the winding up. Mr. Collins does not say whether his hour and minute hands both revolve round the same center or not: it is an essential matter for them both to revolve on the same center, in order to make them plain and easy to understand.

Your obedient servant,

Josh. Varley.

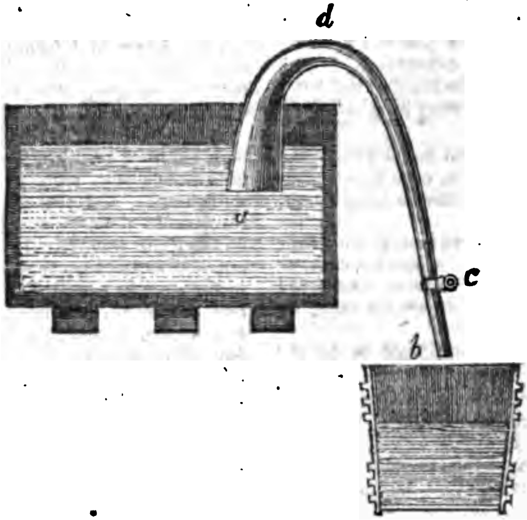
METHOD TO MAKE TIN RESEMBLE SILVER.

Melt 4 ounces of fine plate brass, and add to it 4 ounce soft fine clear tin; when it is in fusion, add 4 ounces of bismuth and 4 ounces of regulus of antimony. Let this flux together, and pour it out into an ingot; then beat it to powder; grind it with rosin, a little salmoniac, and turpentine; form it into balls, and let them dry in the air; and when you would use them, beat them fine; strew the powder thereof upon the melted tin; stir it well together, and continue putting the powdered balls upon the melted tin, until you perceive it white and hard enough: of this tin, you may draw wire for hilts of swords, or make buttons; it will always retain its silver colour.

J. H. Williamson.

Chalton Row.

CONICAL SYPHON.



I have found a syphon of the above form discharge liquor much faster than those in common use. I was led to this discovery from having used the head of a small still for the same purpose. *a* is the vessel from which the liquor is to be discharged; *b*, the one into which it is received; *d*, the syphon, and *c* the stop-cock. In the one which I constructed, the end, *a*, is about two inches in diameter; the end, *b*, about three quarters of an inch; and the whole about three feet long. The mode of using it is the same as in the ordinary syphon. If you think it worth a place in your valuable Magazine, it is at your service.

P. Vanryde.

[We shall be happy to receive Mr. Vanryde's model of a garden-bench. —Ed.]

MECHANICAL GEOMETRY.

Part II.

Definitions.

1st. A circle is, geometrically speaking, a plane figure, bounded by one continued line, from which, if we draw any number of straight lines to a certain point within it, these lines are all equal to each other, and, mechanically, is that figure described by a pair of compasses having one leg fixed; and the other, by revolving round it, describes one continued line, which is called the *circumference* of the circle.

2nd. The point in which the immoveable leg of the compasses is fixed is called the *centre* of the circle.

3rd. Any straight line drawn from the centre to the circumference is called the *radius*, and is therefore equal to the opening of the compasses by which the circle is described.

4th. Any straight line drawn from the circumference through the centre, and terminated by the circumference on the other side, is called the *diameter*, and is therefore equal to twice the radius.

5th. Any other straight line drawn to meet the circumference in two parts is called a *chord*.

6th. A *semicircle* is a figure bounded by one-half the circumference and a diameter.

7th. A *quadrant* is a figure bounded by one quarter of the circumference and two radii.

8th. A *segment* of a circle is any

part of the circumference joined by a straight line or chord.

9th. A *sector* of a circle is any part of the circumference joined by two radii drawn from the centre.

10th. Any straight line that touches a circle without cutting it is called a *tangent*.

11th. Any straight line drawn from the centre of a circle, cutting the circumference and meeting a tangent, is called a *secant*.

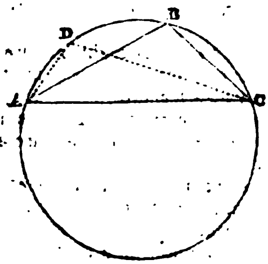
12th. Any straight line drawn from the circumference of a circle, and perpendicular to any diameter, and terminated by the diameter, is called a *sine*.

13th. Any angle is said to be at the centre of the circle when the two lines forming the angle are drawn from the circumference, and meet in the centre; or any two radii form an angle, which, in the language of geometricians, is said to be an *angle at the centre*.

14th. An angle is said to be an *angle at the circumference* when we draw any two straight lines from the extremity of a chord to meet in the circumference; or two chords that meet each other in the circumference is said to form an *angle at the circumference*.

Theorem I.

If, from the extremity of any chord, we draw any two lines to meet in the circumference, the angle that they form at the circumference will be always the same wherever the point they meet be situated in the segment; or, which is the same thing, the angle formed by two chords in any segment of a circle is always the same, in whatever point of that segment they may meet.



Let A C be any chord, from the extremities of which, if we draw any two lines, as A B and C D, to meet in B, we have to prove that the angle A B C will be always the same, wherever the point B is situated in the segment A B C.

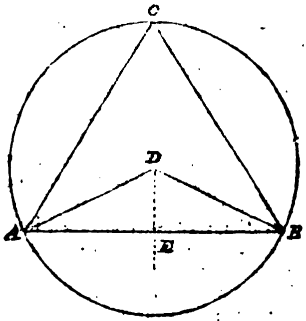
For, let any other two lines, as A D and C D, be drawn meeting in D; then, if we open a carpenter's rule till the legs correspond to the lines A B and B C, we shall find that the same opening will correspond to the lines A D and D C.

Or, cut out a piece of card, &c. to correspond to the angle A B C; we shall find that, by applying the angular point B to the point D, the sides forming the angle will correspond to the lines A D and D C.

Corollary 1. Hence we see, that in any segment of a circle, if we describe any triangle, the sum of the sum of the angles at A and C will always contain the same number of degrees, and which is always equal to that at the circumference subtracted from 180; for it has been shown, in Theorem 5, Part I, that the sum of the angles in every triangle is equal to 180 degrees.

Theorem II.

If, from the extremities of any chord, two lines be drawn to the circumference, meeting each other, and also two lines be drawn from the extremities of the same chord, and meeting at the centre of the circle, the angle at the centre will be equal to twice that at the circumference.



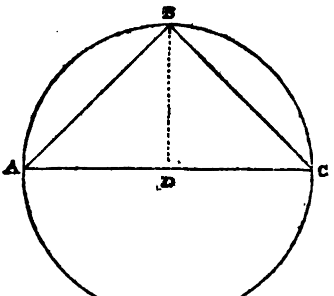
Let A B be any chord, and A C and C B any two lines meeting the circumference at C, and also A D and B D, two other lines meeting at the centre D; we have to prove that the angle A D B is double that of A C B.

Open a rule or bevel to the angle A C B, and apply the side A C to A D, and draw the line D E along the other edge of the rule; then is the angle A D E equal the angle A C B; and if we now apply the rule to the angle B D E, we shall find that it also corresponds to the angle A C B; hence we have the angle A D B made up of the angles A D E and B D E, which is equal to twice the angle A C B.

Or, the same may be shown, as in the last Theorem, by cutting out the angle A C B, and applying it to the angle A D B.

Theorem III.

If, from the extremities of any diameter of a circle, any two lines be drawn to the circumference meeting in an angle, that angle is always equal to 90 degrees, or it is a right angle; in other words, the angle in a semicircle is a right angle.



Let A B C be the angle formed by two chords A B and B C, drawn from the extremities of the diameter A C; we have to show that the angle A B C is a right angle, or equal to 90 degrees.

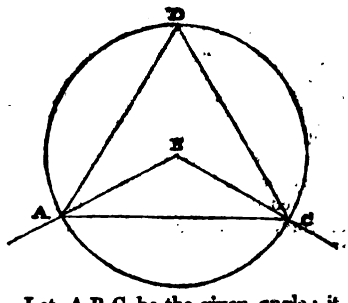
From the centre D of the circle, make D B perpendicular to A C by any of the methods already shown in Problem 4, Part I, or by means of a square; then from B draw B A and B C: now, as B D is equal to D C or A D, we have, by Theorem 4, Part I, the angles D B C and D C B, and also the angles D B A and D A B, all equal to each other; and as the angles B D C and A D C are both right angles, then the other angles are each equal to half a right angle, or 45 degrees; also the two angles A B D and D B C, being both equal to 45 degrees, they together form the angle A B C, equal 90 degrees, or a right angle; and it has been shown in Theorem 1, Part II, that wherever the point B is situated, the angle will always be the same, or equal to 90 degrees in this case.

Or this theorem may be proved at once mechanically, by applying a square to the angle A B C, drawn in a semicircle.

Note.—By the consideration of these theorems, the following practical problems present themselves:—

Problem 1.

Any angle being given, to make another angle that shall be equal to the half of it.



Let A B C be the given angle; it is required to make one which shall be equal to half of it.

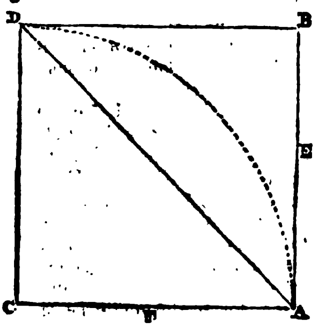
From B set off B A and B C equal to each other, and describe the circle A D C; with that radius and from any point, as D, draw D A and D C; then is the angle A D C equal the half of the angle A B C. Hence we have not only a method of drawing a true mitre, or angle of 45 degrees, but also of drawing the mitre to any given bevel; for if the angle be a right angle, the angle A D C will be a true mitre; and also, if the angle A D C be the bevel of any frame, &c, the angle A D C will be its mitre; and hence we have another method of knowing when the instrument called a *mitre square* is correct, besides that shown in Problem 5, Part I.

(To be continued.)

PROJECTILE AND GRAVITATING FORCES.

Aug. 7, 1824.

SIR;—On the receipt of this day's Number, I was much surprised at seeing an article on the subject of "projectile and gravitating forces," tending to overthrow the whole system of the Newtonian philosophy; and much I wish, that before your correspondent had solicited others to consider the subject, he had himself given it but a few minutes' consideration; he would not then, I am sure, have had the boldness to advance any thing against what has been so clearly demonstrated to be a fact; and if he had referred only to Ferguson's Lectures on Mechanics, he would have had actual experiment to show the truth of what he now contradicts, viz. that "a *double* projectile force is always equivalent to a *quadruple* power of gravity; and, as I conceive a great portion of your readers would not be edified by any abstruse mathematical demonstration, I shall endeavour to set the subject in such a light as, I trust, will convince even *Majertingun* of the error of maintaining opinions so contrary not only to those generally received by men of science, but also contrary to experimental knowledge.



Your correspondent sets out with a known truth in mechanics, and which he does not attempt to deny, viz. that if two equal motions are communicated to a body at A, in the direction of A B and A C, it will, by that compound motion, move in the direction of the diagonal A D. Now, he considers the line A B as produced by the projectile force, and the line A C as that produced by the force of gravity. So far we are agreed: but he must also consider the force A B as regular and constant, moving over equal spaces in equal times; that is, the body at A would move from A to E (half the distance of A B) in half the time it would move from A to B: now, it is not so with the force of gravity, or that of A C; for gravity causes an accelerated motion; that is, if a body, by the force of gravity alone, moves from A to C, it will move with greater velocity as it approaches C, and thus will move from A to F (the half of A C) not in the same time it moves from F to C, for the force of gravity is continually increasing; and thus, though by the compound forces of gravity and projectile force, the body would be found at D, yet it would not describe the diagonal line A D, but that of a curve, being the quarter of a circle from A to D.

Now, to show that a double projectile force is always equivalent to a quadruple force of gravity, let the force impressed on the body at A by the projectile power, be such as to carry the body from A to B in any given time, suppose one hour; and the force of gravity impressed on it in the direction A C, such as will carry it from A to C also in one hour. The question, then, we have to consider is, first, how far will the body A be carried in the direction A B, when that force is doubled, or how far will it go in two hours? The answer is plain; it will be carried twice as far, or equal to 2 A B; and secondly, if the motion of the body in the direction A C be continued (by the force of gravity) for two hours, how far will the body be from the point A? By the laws of falling bodies, it will be found, that it will be distant from A equal to four times A C; for it is found by experiment, that a body will descend by the force of gravity 16 feet in a second of time; and in two seconds it will descend 64 feet, that is, four times 16 feet, and so on increasing as the squares of the times. In fact, it appears that the whole error of your correspondent is in considering the action of gravity as uniform at the commencement of the motion of the body, without at the same time recollecting, that when the body once begins to move from the force of gravity, it is continually accelerated; for if he had, he would have found, that instead of resolving the compound motion of the body by the two forces into the diagonal of a square, he would have proved it to be the diagonal of a parallelogram, whose sides are as one to four, supposing (as he does) that the force of gravity and the projectile force are equal at the point A, when the body begins to move.

I cannot conclude this subject without just touching on what *you* observed respecting Captain Forman on "the laws of gravity." Now, I do not see any analogy between the force of the current and the muscular force exerted to reach the shore, as regards the gravitating and projectile forces, as both these forces are uniform, and neither are in their nature accelerated; for, by his own account, the swimmer must exert a quadruple force to overcome a quadruple force, and both are, in their nature, projectile forces; that is, passing over equal spaces in equal times. But suppose the projectile force of the stream to be at once doubled, and the man from that time till he reaches the shore to be continually accelerating his speed according to the laws of gravity (which experiment has been clearly shown to be as the *squares* of the times); if he reaches the desired spot on the shore, it will be found that at the *moment* of reaching it, he has exerted a quadruple force to that with which he set out, proving that to balance a *double* projectile force of the stream, he must exert a quadruple muscular force at the instant he touches the bank.

Thus I have endeavoured to show, that "Mejertingun" has been led into an error, by supposing the force of gravity to act at A, instead of placing it at C, and there making it equal to the projectile force applied at A in the direction A B; for if he applies it at A, it necessarily increases towards C; and by the time A has reached B, the line A C would be described equal to four times A B.

I have purposely avoided any abstruse mathematical demonstration of the above; as I conceive your useful miscellany is not meant as a vehicle for abstruse science, but as a means of information and improvement in the practical purposes to which the mathematical sciences may be applied. But should your correspondent wish a strict mathematical investigation and demonstration, I would refer him, amongst many other authors, to Simpson's Select Exercises, p. 179 and following, and Barlow's Mathematical Dictionary, article "Projectiles."

G. A. S.

P. S.—If your correspondent can furnish me with any mathematical demonstration of the truth of what he asserts, I pledge myself to show the fallacy of his argument by the same means.

MECHANICS' INSTITUTION.

London, Sept. 6, [illegible]

SIR;—Long acquaintance with able engineers and intelligent mechanics, has given me, if not a knowledge of the principles and practice of the mechanical arts, a conviction that upon these and their professors depends much of the prosperity of the country, and a consequent wish that every exertion should be made to call forth, direct, and reward mechanical talent. I have often seen, with regret, men of the most active natural powers and most persevering industry, throwing these away upon idle schemes and impossible speculations, from not knowing the principles of mechanical philosophy. I have also seen admirable inventions, improvements, and hints, sharing the obscurity of their authors, through the mere want of the means of bringing them before the public.

Your spirited and truly patriotic Journal appeared at first to promise the supplying of several of these desiderata; and the result has fully proved, that the promise was not an empty one. From its style, I should suppose that much of it is furnished by operative mechanics; and, though the merits of its contents be varied, I know of no journal of the time which contains the same quantity of original and practically useful matter.

It was with great pleasure that I saw that Journal, while yet in its infancy, inviting the mechanics to combine and supply for themselves the remaining desiderata. The call was answered—the mechanics met—an Institution was formed—a code of laws framed—quarterly meetings held—gratuitous lectures given (I did not much like the term *gratuitous*)—and votes of thanks passed and recorded. Thus far all promised well; and the example was followed in other parts of the kingdom.

In the course of last winter and spring, several practical mechanics—men who knew what their brethren wanted, and how the want was to be supplied,—called upon me, and complained that their hopes were in danger of being frustrated. They alleged, that the laws of the Institution were unintelligible in some parts, and illiberal in others; that the mechanics had consigned over the very existence of the Institution to the Committee; and that the Committee (though no doubt actuated by the best intentions), were omitting to do those things upon which the present usefulness and consequent future permanence of the Institution must depend. They stated, particularly, that their hope had been, that the Institution would have instantly afforded them the perusal of those books which, though necessary for a knowledge of their professions, they were unable to purchase, and which are not to be found in any of the common circulating libraries; and that steps would have been taken to establish courses of instruction a little more precise and practical than the popular and desultory lectures which they had occasionally heard.

These communications induced me to look at the laws, and ultimately to become a member of the Institution. In the laws I certainly found not much that I could approve, and not very much that was explicit; but as I concluded the laws were a first attempt at legislation, I inferred also that the practice would be more clear and liberal. It was, therefore, with no small degree of astonishment, that I found the Committee, without any power given them by the laws, converting the audience after a lecture into a "special general meeting," for the purpose of approving a step, on the part of the Committee, which, to say the least, ought in fairness to have been discussed at two or three successive general meetings. The step to which I allude, was the procuring of a building, *unfit* for the only thing the Committee are in a condition *to afford*—the *gratuitous* lectures; and this at an expense which, together with the secretary's salary and contingent charges, appeared, upon the showing of the Committee themselves, likely to consume the average annual revenue of the Institution, as arising from its ordinary members.

You, Sir, objected to the meeting as a contravention of the laws: it struck me in the same way, and I supported your objection. I would have objected to the proceeding upon the ground of its own merits; but certain members of the Committee declared, in no very seemly or temperate language, that the Committee had full powers to dispose of all concerns of the Institution as they chose; that they had, in fact, determined upon this step previous to the constituting of the meeting, and that they merely gave the members permission to say it was well done, as an alms—"a boon."

This declaration was quite enough, not only to show what the Institution could do under its present management, but to enable one to count how long it will last (at least as a *Mechanics'* Institution), if this mode of management be not changed. This, however, was not all. The Chairman admitted, and the Members seemed to agree, that the meeting, if not "clandestine" (as they were afterwards so angry with you for calling it), was *ex post facto* upon their own showing, and incompetent in consequence of the delegation of all power to the Committee. It was accordingly agreed, that the thanks which it gave for its own helplessness should be entered on the minutes, merely as the thanks of "a number of the members;" but if my memory does not fail me, when the minutes came to be read at the last regular quarterly meeting, these same votes were described as being sanctioned by a special general meeting, legally constituted, and this notwithstanding they had distinctly acknowedged that there was no law for its constitution. Truly I may add, "where no law is, the people perish."

Anxious that another meeting should not pretend to do that which it had no power of doing, and then be set down on the record as having done it, I, on Wednesday, the 1st inst., objected to the calling of yourself and the Editor of another public print before the inquest of the Meeting; or, to speak correctly, of the Committee. Agreeing with you in the truth and justice of what you have said, I was prepared either for an explicit explanation, or a becoming silence on the part of the Committee; and had the allegations which you published been brought before the Meeting in a legal and orderly manner, I should have held the want of such an explanation as a proof of the facts: as the matter was managed, every one who gives himself the trouble of inquiring, will be of this opinion. Anger is not argument, and the clamour of partizans is not the establishment either of capacity or of purity. I am far from saying that the Committee of the Mechanics' Institution have injured it from intention, That they have done it good, I shall say when they point out that good, but not till then. It is really much to be regretted, that the mechanics of London should have got into the hands of men who seem incapable of doing right, or of listening to instruction. Your Magazine called this Society into existence: perhaps it may call the Committee to amendment. It is in this spirit, and with this intention, that I write you. Stand firm: you are in the right.

Your obedient servant and fellow-labourer for the interests of mechanics, ROBERT MUDIE.

THE PERPETUAL MOTION.

June 4.

SIR;—In your publication of the 29th ult., I read, with no little dissatisfaction, the very discouraging opinions of Mr. Deacon against the efforts of all those who may in future attempt the discovery of perpetual motion. Now, notwithstanding these opinions and the *mathematical demonstrations* that have been advanced, of the impracticability of such a discovery, I feel no hesitation in standing up in support of this grand *desideratum*, this almost forsaken friend of science, *whether the thing be practicable or not*. I say this under the impression, that much good has already been derived from the *proposition*, which I hope to make appear; and I will endeavour likewise to show, that all decision against the discovery being practicable, is premature; and Mr. D. or Mr. E. may give me a place in his Dunciad if he please.

It is no very agreeable thing for a man's hobby to be run down, because it may not suit the taste or judgment of others. We have all our hobbies; and unhappy is he who is destitute of one. Neither is it wise on any occasion to dishearten because endeavour has hitherto been unsuccessful. On the contrary, *persevere* should be every one's advice; to do so, or discontinue, every one's own pleasure. And why should the impossibility of any thing be pronounced, unless it be established wherein the limits of possibility consist?

The problem to find a perpetual motion, in my humble opinion, has done more general good in the cultivation of science than any other whatever. In endeavouring to solve it, the apprentice, however imperceptibly, becomes acquainted with principles of mechanics, which make a lasting impression on his mind, and eventually give him a strong desire after information in one branch or other of learning. One would really think the case a perfectly isolated one, neither growing out of the general system, nor dependent on the general powers of nature, and only useful for the gain it might be productive of to the individual, on reading the sweeping clauses pronounced against it, and against the speculations of all men who may spend a little time on this, which I call, most interesting question. But as there is no branch of science in which the experiment may not be tried, and as the knowledge of every practitioner must be improved by repeated trials, it is puerile in the extreme to be foretelling defeat, when so many other objects may be gained by the highly laudable pursuit, perhaps of greater advantage to society at large than the discovery in question. Hope is not the less sweet for being fallacious. Failure in one point, may for a while dishearten, but it can never alienate from the mind the knowledge acquired. A harvest more than golden may be reaped, although different from that anticipated, which first induced the plough to be resorted to. And who can say that the ambition to discover the perpetual motion has not been the origin of the highly honourable career run by many of the great geniuses which this and other countries have produced, and that have so honourably terminated in wealth and fame? Will any man make his child desist from pushing his ideas in science, because he cannot perfect what he intended? In a word, were the perpetual motion discovered to-morrow, it would be wise of all the governments of the world to offer a very high reward for some species of discovery that would be universally sought after, although it might never be found out. Hope, like faith, it is true, may exist on a very irrational basis; but the calculation is to be made by the good produced, and not always by the standard of rationality or truth. Then let us, in the name of goodness, be allowed to *whittle on*! The effects of industry are, enlargement of the mind, accumulation of knowledge, and rendering ourselves ignorant of the torments which idleness and dulness always engender. Besides, discovery is indebted to inclination as well as to necessity among men. Time employed, is time carried with us: in what the employment consists, avails nothing; persevered in, it may carry us to honour, wealth, and fame; but most assuredly it brings tranquillity of mind. In the next place, *there are no solid grounds for the assertion that the discovery of a perpetual motion is an impossibility*: in the present state of human knowledge respecting the powers of nature, it is not demonstrable one way or another. Mr. Deacon is right in stating that "the validity of every invention" (sought after) "can only be fairly tried by a comparison with the unerring laws of nature." But he adds, "We can always avail ourselves of this most simple test," which is an assertion the most difficult to prove of all others whatever, and *ever* must remain so, until we become acquainted with natural causes themselves, and consent to forego the many assumed ones with which human science at present abounds. Effects may be correctly calculated, although we may be in great error as to their cause; and while this is the case, we must inevitably be ignorant of all the changes in nature which are possible; and which, under hypothetical data, we never could have thought of. And then, *authority* in opinion rules and over-rules, to the great hindrance of native genius and originality of thought being their own preceptors. Thus does dogmatising confine the human faculties to the train-roads of dulness and error: hence it is that learning has such little increase, while the number of learned men is ever on the increase. The study of what relates to the perpetual motion, has this great advantage, that it directs to the discovery of error, as well as of truth; whereas, what are they which are called truths of science at present but vacillating human opinions, or erroneous assumptions of what we call natural causes? What are they but such as consist in mere assumption, sanctioned by time, and admitted by existing authorities in science, and of course generally acquiesced in, without previous investigation?

"Mathematical demonstration," or "experimental proof," is the stern condition on which alone the student in science can have his opinion listened to, however highly rational, by a sage professor now-a-days. At the same time, mathematics have never yet discovered the physical or chemical nature of any thing whatever; neither is experimental proof of such an infallible nature but that opposite opinions are daily given in illustration of the same experiment; nor has a single experiment ever been understood in every point of bearing whatever. To which may be added, that there is no experiment, since the commencement of science, but what has been erroneously accounted for, if there be no such principle as attraction, of the actual existence of which all nature does not afford one single demonstrable proof. So far, then, from being guided in our decision, respecting what is possible and what is not possible, by the "unerring laws of nature," by "mathematical demonstration," and by "experimental proof," we are constantly misled by an erroneous faith in the *non-entity*, attraction. And this assumed power serves but to show how we are borne down by existing opinions, and how very conveniently we avail ourselves of "*tests*" which have no existence in nature. Attraction is a motion—destroying principle; whereas the phenomena of nature depend altogether on motion. Attraction would prevent a man lifting his legs, a fly having the power of locomotion, a mist from ascending into the air, and air itself from having any existence as an atmosphere to the earth. Again, how little is known wherein the CAUSE *of continued motion* consists, when it is concluded that motion or force goes out of one body into another; as if motion, which is but mere change of place, were any thing transferrable; and as if force were a substance. If, then, motion be nothing, how can accelerated motion be attributed to the accumulation of nothing? And as a body cannot either give itself motion, or increase its own motion, the cause assigned for motion being accelerated, amounts to this—that motion, which is nothing, can and does cause its own increase—than which there can be nothing more nonsensical. On such an imperfect knowledge of the causes of phenomena, who should say he knows what can or what cannot be discovered?

Until these errors in science are abandoned, and the "unerring laws of nature" discovered, I see no "test" as yet to compare by, whereby any one is authorized to say that the *true motion-making cause* may not yet be employed, so as to produce perpertual motion on some species or other of mechanism.

T. H. Pasley.

INQUIRIES.

No. 65.—DECYPHERING INSCRIPTIONS.

Sir;—I have been endeavouring to decypher, from an old tomb-stone, an inscription of considerable importance in establishing a family claim; but from the *faintness* of the letters, though they are perfect in their form, and uninjured, I have hitherto failed in my attempts. If any of your ingenious correspondents can devise a plan which, by means of impression or otherwise, the inscription may be taken off, the invention will be generally useful, but more particularly to your obedient servant,

Investigator.

No. 66.—EXTRACTING FAT.

Sir;—I should be glad to learn from some of your intelligent correspondents, whether there is any (and what) method of rendering (extracting) butcher's fat by steam, or any plan for setting a rendering furnace in such a manner as to prevent it coming immediately in contact with the fire, and yet obtain the requisite degree of heat. That a certain portion of the fat may be rendered by steam, I am well aware from my own experiments; but I wish more particularly to ascertain if it is possible to extract the tallow, so far as to bring it down to the greaves, which in the present process requires such an intense heat. J. T.

NEW PATENTS.

To William Wheatstone, of No. 118, Jermyn-street, Westminster, music-seller, for an improved method of improving and augmenting the tones of piano-fortes, organs, and euphanons.—29th July—2 months.

To John Fussel, of Mells, Somersetshire, edge-tool maker, for an improved method of heating woollen cloth for the purpose of giving it a lustre in dressing. —11th August—2 months.

TO CORRESPONDENTS.

G. Wilson: the model of which he speaks never reached us. We shall endeavour soon to give a description of his improvement.

We shall be glad of the loan of the work mentioned by "A Stripling." He will be so good as leave it at our Publishers.

"Paupertas" would see that his paper was inserted in our last Number.

Communications received from Mr. Hayter — Barometer — Marksman — Inquirer — B. S. — D. — Wm. B. C. — A Constant Reader—Finical—John Bird—An Original Subscriber—Charles Seward—Dixon Vallence (whose previous communications are intended for insertion) —T. Tipman—G. Brand—A Learner—D. E.—P.—A. Z.—T. H.

Three o'clock, Thursday Afternoon.—We have this moment received two letters, one from Dr. Birkbeck, on the distinction between "honorary" and "gratuitous" lectures; and the other, signed B. T., on the general subject of the conduct of the Committee of the London Mechanics' Institution, to both of which we deem it but fair to give a place. As we are obliged, however, by our extensive circulation, to send each week's Number to press on Thursday afternoon, their insertion is necessarily postponed till next week.

LONDON MECHANIC'S INSTITUTION.

The following are the fifteen new Committee-men elected on Tuesday last, to fill the place of those retiring from office:—

Mr. Dotchen,	Mr. Bacon,
Mr. Blake,	Mr. Thompson,
Mr. Cope,	Mr. Loop,
Mr. Reynolds,	Mr. Place
Mr. Tennant,	Mr. Hachett,
Mr. Appleby,	Mr. Ethell,
Mr. Cheese,	Mr. Corbedon.
Mr. Bonnick,	

ERRATUM.

The following obvious erratum can scarcely have escaped the notice of our readers: p. 414, 2nd col. *l.* 11 from the bottom, for "*concave*" read "*convex face* undermost."

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T. C. Hansard, Pater-noster-row Press.

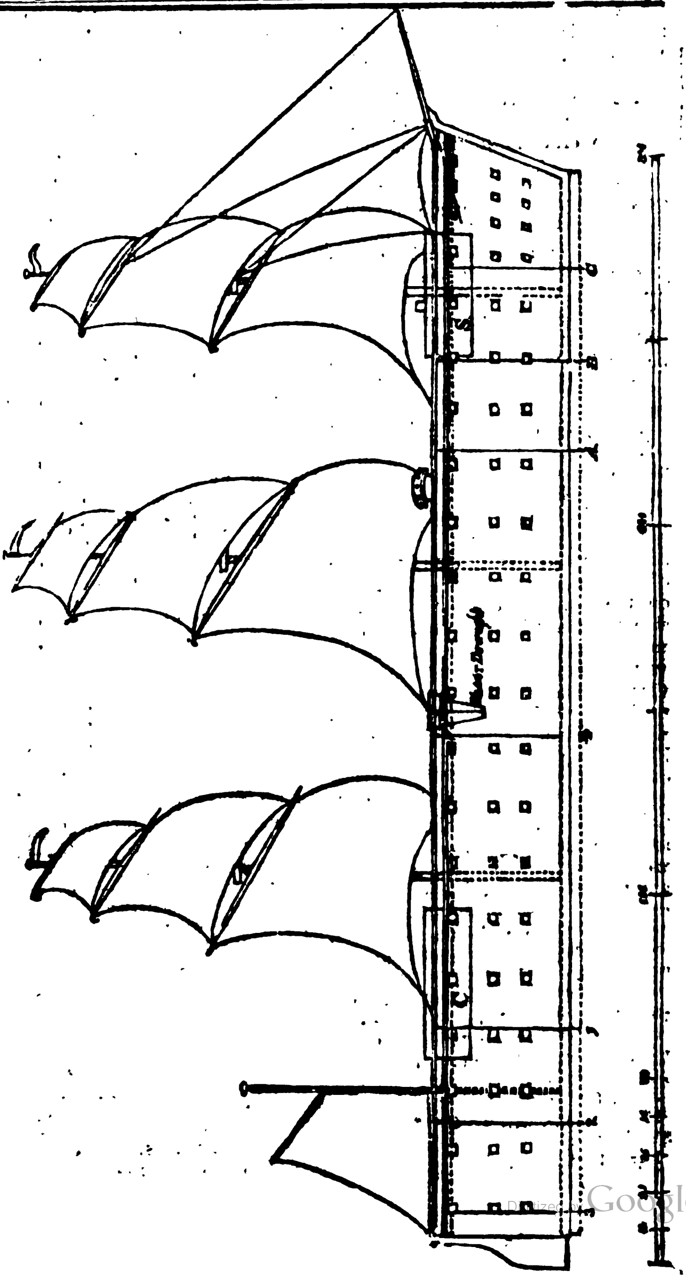
Mechanic's Magazine,

Museum, Register, Journal, & Gazette.

"The most valuable gift which the Hand of Science has ever yet offered to the Artizan."—*Dr. Birkbeck.*

Activity animates a wilderness, transforms a cell into a world, bestows immortal fame on the calm philosopher in his chamber and on the industrious artist in his workshop.
Zimmerman

No. 56.] SATURDAY, SEPTEMBER 18, 1824. [Price 3d.

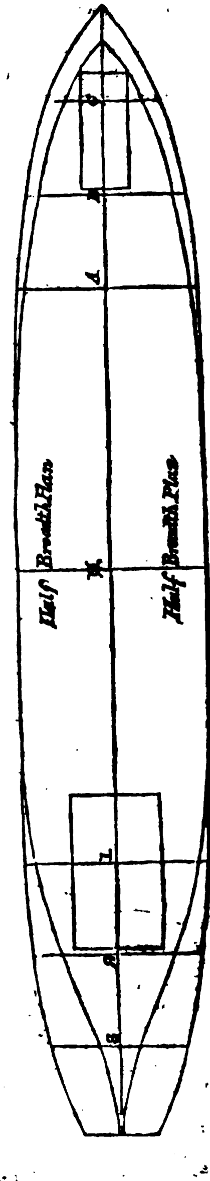


THE LARGEST SHIP EVER BUILT.

THE LARGEST SHIP EVER BUILT.

We this week present our readers with accurate drawings of the ship Columbus (first noticed in this country at p. 64, Vol. II, of our Magazine), which was launched about six weeks ago, at Port Glasgow, in the Isle of Orleans, river St. Lawrence, and is now on her way to this country, where her arrival is expected with no ordinary interest, being by far the largest ship ever constructed, either in ancient or modern times. The drawings were made from the ship itself while building at Port Glasgow, by an officer of his Majesty's service, and have been kindly communicated to us for publication. The tonnage register of the Columbus is 3,690 tons, but she is thought to be capable of carrying at least 6,000 tons freight. Her length aloft is 301 feet; her extreme breadth 50 feet 7 inches; the depth of hold, 29 feet 6 inches. She is built exactly on the plan of a Canadian batteau, being perfectly flat-bottomed and wall-sided, with the stern and stern-post nearly or altogether perpendicular, and both ends sharp, with very little of the fulness of bows and sterns on the ordinary construction. Her side timbers are connected by very massy beams, and but for these she would probably freight 7,000 tons. Our first view on the preceding page, exhibits an entire section of her lengthwise; the column-cut on this page, a half breadth plan; and the smaller drawing on the next page, a section of her after-body (1 2 3) and fore-body (A B C). C is the cabin, and S the steerage; from the elevation of both which, it will be seen, that should the vessel by any means become water-logged, the crew could endure but little inconvenience. The weight and dimensions of her ground tackle are as follows:—

	Tons.	cwt.	qrs.	lbs.
1 Chain-cable, 2 inches diameter, 120 fathoms	11	9	0	6
1 Do. do. 120 fathoms	11	7	2	20
1 Anchor for chain-cable, 80 cwt. 1 qr. 27 lbs. .... Shackle therein, 2 cwt. 3 qr. 11 lbs.	[illegible]	3	3	10



The following additional particulars of the building and launch of this extraordinary vessel we extract from Canadian papers:—

From the Quebec Mercury.

"This ship has been an object of general curiosity since she was first laid down, her dimensions so far exceeding any which have yet been attempted in the largest ships of war, that even a faithful report of the bulk was received with suspicion, and a number of vague stories were set afloat as to the intentions of the builders in framing this wonderful craft. It was imagined by many that a solid mass of timber was to be built in something like the shape of a vessel, and covered with an outward sheathing of plank, sufficiently strong to render her capable of traversing the ocean at a favourable season, when good weather might be expected; but as the work advanced, it became evident, from the regular plan pursued, and the solid manner in which her massive frame was connected, that something more was intended than a mere ship-shaped raft: she is now a complete vessel, and it is expected will prove sufficiently manageable. Many persons entertained doubts of the possibility of launching this stupendous fabric; and there were not wanting those who affirmed that she would never float, but remain on the blocks where she was built, a monument of the presumptuous folly of the projectors.

"The events of Wednesday (the day on which she was launched), proved how much the wonderers and doubters had been mistaken, and showed how ably the work had been conducted, and how minutely and justly the builder had made his calculations. At half-past or thirty-five minutes past seven o'clock, this ponderous mass was put in motion with as much facility as any smaller vessel, and slid majestically into the St. Lawrence. The length of the ways was somewhat less than 600 feet, and precisely one minute elapsed between the period when she moved, and that of her reaching the water; her entrance into which was greeted by appropriate airs from the military bands in attendance, and repeated salutes from the guns of the steam-boats, and some which had been planted on the shore for that purpose. Her ways were much scorched by the friction of her motion, and so great a smoke arose, that distant spectators imagined some accident to have taken place. From her peculiar construction in the wedge-like form of her stern, and the small proportion her breadth beam to her length, she created but little swell; even the smallest boats were hardly tossed, and no sensible motion was experienced on board the steam-boats and larger vessels.

"Three of her four masts were standing, that is, the first and second main-masts, and her try-sail mast. The sheers were also up for stopping the fore-mast, and her bowsprit was in; the whole of these appear so small, when compared with the bulk of the hull, that they look like jury spars: her mainmast is not larger than that of a small 74. As soon as she lost way, she was taken in tow by the steam-boats, *Swiftsure*, *Lady Sherbrooke*, and *Malsham*, and conducted to the Montmorenci Channel, where she dropped her anchor, which did not appear to us larger than we have seen on board a first-rate ship of war. The weight is 78 cwt. 2 qrs."

From the Montreal Herald.

"Never, we are informed, was there such a scene witnessed in Canada: and never did the population of Quebec exhibit so interesting a spectacle as upon the present occasion. There was not a steam-boat or other aquatic conveyance in port fit to be hired that was not put in requisition, and the most of these being furnished with bands of music, and decorated with flags and streamers, approached the scite of the launch in a manner truly unique and highly appropriate to the business of the morning. The moment at which this leviathan was knocked off the blocks, and plunged into her native element, was really interesting and grand; and words are only wanting to convey the thrilling emotions which heaved in every breast, when the happy circumstances of the safety of the vessel herself, and all around, was pronounced by one unanimous and rebounding cheer from all present."

The Columbus was to set sail for London, with a cargo of timber, about the middle of August; so that we may expect very shortly to have the gratification of seeing her in the Thames. Of her accomplishing the voyage in perfect safety, we have not the smallest doubt. This is not our own impression alone, but that of several most experienced ship-builders, with whom we have conversed on the subject. Should she even happen to take ground on some of the banks on the American shore, or at the mouth of our own river, she is so constructed that she can receive no material damage, and can easily be lightened, by cutting off, in the one case, a proportion of the upper part, or in the other, discharging part of her cargo by means of lighters. The most difficult part of her navigation will be the Swin; and it would, perhaps, be prudent in the owners to have a steam vessel or two in waiting, to tow her through that passage into the port of London.

LONDON MECHANICS' INSTITUTION.

We gave in our last the names of the fifteen new Committee-men elected; and we have now to state that of these fifteen, ten are described in the Balloting List as belonging to "the working class," and five as "*not of the working class.*" Of the fifteen who have retired from office, *only two* were "*not of the working class;*" so that by the new election the Committee *acknowledge officially* that they have increased by *three* the number of *not working members*, or *gentlemen* among them.

Let us now see how this result corresponds with the design of the Institution, as expressed in its statutes. By the 4th article, it is declared that the Committee shall consist "in the whole" of *thirty-six persons;* and by the 5th it is provided that "TWO-THIRDS *at least*" of the number "*shall be taken from the working classes,*" that is, that there shall not be more than *one-third*, or *twelve*, masters or gentlemen in the Committee, so that the working classes may always have a predominating influence, if they choose to exercise it in the management of *their own*, or what *should be their own* Institution.

In the election of the *first* Committee, this relative proportion of numbers was strictly observed, there having been *more* than two-thirds of the members working mechanics; but from the way in which the last election has been managed, so little regard has been shown both to the letter and spirit of the laws on the subject, that instead of *twelve at the utmost*, there are now thirteen members of the Committee who are AVOWEDLY "*not of the working class,*" and at least *one* person besides, who has been smuggled in, under the title of a working mechanic, who is, to all intents and purposes, as much a master as any of those who have been openly introduced in that capacity. That no possible doubt may exist as to the correctness of our statement on this point, we shall here insert the names of the thirteen Members of the Committee as now constituted, who we say are avowedly not of "the working class." Those marked with an asterisk are the five last elected, and who in the Balloting List are officially described as "*not of the working class.*"

PRESIDENT.

1. DR. BIRKBECK.

VICE-PRESIDENTS.

2. JOHN MARTINEAU, ESQ. *Engineer.*
3. PROFESSOR MILLINGTON
4. DR. J. B. GILCHRIST.
5. ROBERT M'WILLIAM, ESQ. *Architect and Surveyor.*

TREASURER.

6. MR. ALDERMAN KEY.

COMMITTEE-MEN

7. WILLIAM FREND, ESQ. *Actuary to the Rock Insurance Co.*
8. MR. RICHARD TAYLOR, *Master Printer.*
9. *MR. J. N. DOTCHEN, *Surveyor.*
10. *MR. JOHN REYNOLDS, *Teacher of Mathematics.*
11. *MR. J. F. BLAKE, *Engraver.*
12. *MR. BENJAMIN TENNANT, *Wine-Merchant.*
13. *MR. JOHN JAMES COPE, *Surveyor.*

The person to whom we allude as having been smuggled in as a *working mechanic*, is thus designated in the Balloting List, under the head of "Candidates of the Working Class:"—"PLACE, FRANCIS, Jun., Tailor, 18, Charing Cross." Now, Mr. Francis Place, jun. as every body must know, who knows any thing of Westminster and Westminster politics, is the son and successor in business of the Mr. Place who thus figures in a late examination before a Committee of the House of Commons:—

"How long have you been in trade?—*As a master*, I was in trade from 1799 to 1820."

As a master Mr. Place was succeeded by the Mr. Francis Place, jun. who is now unblushingly attempted to be passed off as a *common workman*—as on a par with his own journeymen, and possessed of feelings and interests like to theirs!

Adding, then, as we are well entitled to do, Mr. Francis Place, jun. to the number of committee-men, who are undeniably "*not* of the working class," we have *fourteen* instead of *twelve* of that class upon the Committee. We assert this much of our own knowledge; but we shall not be surprised to learn, that there are even more of the same description upon it; for men who could be accessary to so flagrant a violation of the laws, in order to bring *two* unqualified members into the Direction, could have no scruples about foisting in a dozen such.

Among the charges which we brought against the Committee, and about which so much has been said, though to this hour they remain unanswered and unrefuted by them, one was, that a violation of certain laws (the 47th and 72nd) was *meditated*. The latter of these laws is that under which this last spurious election has taken place. The members of the Mechanics' Institution, and the Public, can now judge, to a certain extent, how far our apprehensions were well founded.

It is an indisputable fact, that a Committee has now the management of the affairs of the Institution which is not constituted agreeably to its laws, and in which the mechanics have been deprived of the number of votes which those laws professed to secure to them, and which it is of such vital importance they should possess.

We did our duty in warning the members of the course matters were taking; and we do again but our duty in calling upon them to correct the wrong that has been committed, by insisting for a new election. If such violations of the laws as this are passed over, the Institution—as far at least as regards any share which the mechanics may have in its management—may be considered as at an end.

It may be well, Mechanics, to remind you of what was said on this very point at the first establishment of the Institution. "The plan," said Mr. Brougham, "will prosper in *exact proportion to the interest which the mechanics themselves take in its details*. It is for their benefit, and ought to be left in their hands as soon as possible after it is begun." Mr. Cobbett "was of opinion, that one resolution at least of the Society at New York was a wise one; namely, that none but mechanics should be allowed to become members of it. It became those who were not mechanics, to subscribe according to their ability; but they had nothing, and ought to have nothing, to do with the management of the Institution. And here he agreed with Mr. Brougham, who stated that he thought the thing should be managed by the mechanics themselves. *If they allowed other management to interfere, men would soon be found who would put the mechanics on one side,* AND MAKE USE OF THEM ONLY AS TOOLS."—[See *Mech. Mag.* Vol. I, p. 181 190.]

We may chance to be blamed by some individuals for not personally attending at this last election, and using every endeavour to *prevent* that infringement of the laws of which we now complain; and we will readily own, that had there been the slightest chance of our *thus* preventing it, we should have been greatly to blame for staying away. From every inquiry, however, that we could make, we found, much to our sorrow, that the greater part of the members, either disheartened at the declining prospects of the Institution, or deterred from interference by the angry spirit in which every thing in the shape of opposition is sure to be met by certain leading managers of the Institution, had resolved to take no part in the election; and that the only persons (with a few exceptions of course) likely to be present, were such as would come prepared to concur in the perfect propriety of hearing only one side of every question, and vociferating down any one who dared to impugn the conduct of the party, to support whose interests, rather than to improve themselves in scientific knowledge, they had become members of the Institution.

That the general feeling of the members had been rightly described to us, is abundantly proved by the event. For, though reduced in number, by the labours of the Ex-Managers, from about 1,000 (paying members) to about 700, the greatest number of votes that could be mustered for any candidate was only 110, and some were returned by less than fifty!

The election, in fact, was entirely the work of the committee-men themselves, and a few personal friends; and the members at large ought, therefore, to feel the less scrupulous about setting it aside. If they have lost all hope of the Institution—in that event only—they will leave matters *as they are*.

Dr. BIRKBECK's LETTER.

We now proceed to insert the letter which we announced last week had been received from Dr. Birkbeck, on the distinction between *honorary* and *gratuitous* instruction.

50, Broad Street,
Sept. 8, 1824.

Sir;—Your attempts, in some recent Numbers of the Mechanic's Magazine, to fasten inconsistency upon me, have not passed unnoticed. Reasons, however, which your recollection of the past, if not quite obliterated, may suggest, have induced me to hope that they were the result of accident rather than design. Your attempt to make me guilty of insulting the members of the "Mechanics' Institution," whilst endeavouring to instruct them, is of a very different description, and of a character which cannot be mistaken. I here allude to a reference to the London Institution, in the last page of your last Number—a reference which you have justly termed unfortunate, and unfortunate it will prove to be, but not to your correspondent. "T. M. B.'s letter, on the other branch of the subject," you remark, "furnishes nothing new, only an unfortunate reference to the London Institution. Dr. Birkbeck's Lectures to the London *Gentleman's* Institution, are styled, in the advertisements of that establishment, *honorary;* the same lectures, when delivered at the London *Mechanics'* Institution, are called *gratuitous*. Is there a mechanic of so mean a spirit as not to perceive and feel the distinction?" Now, this writer, whose letter, instead of being inserted, is dismissed with an editorial sentence, had stated, I suppose, that there could not be any thing offensive to the feelings of the mechanics in lectures delivered to them without remuneration, by one who had repeatedly done the same thing for the wealthy members of a well-endowed institution; and, therefore, that in one instance at least, your assertion, that the lecturers were too proud to receive any recompense from the mechanics, might be incorrect: when, lo! you discover, that because these lectures are styled honorary, their nature is changed, and they cease to be gratuitous. Admirable distinction! The shadow of a shade is a gross figure when applied to represent such amazing tenuity. But in order that the spirit of the mechanic to which this malignant appeal is made, should feel this distinction so as to make his resentment fall where you wish it, this curious distribution of epithets must be proved to have been made by the same individual; and that individual have connection with the Mechanics' Institution. Now, as I am the only person who have the appearance of being so circumstanced, I feel myself subjected by you, to the best of your ability, to the painful consequences which might follow this attack: it is therefore necessary for me to declare, which I do most unequivocally, that the advertisements alluded to were neither drawn up by me, nor with my knowledge of their contents; and that whatever I may have styled lectures, I never did publicly, at any time, or even privately, I believe, affix to a lecture, or a course of lectures, an epithet so inapplicable. Further, I may declare (not having the slightest recollection of the contrary), that I have not applied the term gratuitous to the lectures which I lately delivered to the mechanics in Monkwell-street. If it had happened to become necessary to use either word, I should have felt myself bound, in consideration of the feelings of the mechanics (which, notwithstanding all you can insinuate, I could not deliberately insult), to select the word objectionable to you. You must remember (for if I mistake not, you still continue keenly to feel), that the first Committee which was appointed, refused to have an *honorary secretary;* and the second public meeting, you surely recollect, rejected, with indignation, the proposal to have *honorary members.* And allow me to ask, if you had been appointed to this anticipated office, as you expected, and as, for the benefit of the Institution, you ought no doubt to have been, did you not expect the services of the honorary secretary to be really gratuitous, or should we not have expected the gratuitous secretary to be honorary also? In the application of either word, where I might happen to have occasion to select one, by whatever etymological subtlety I might be influenced, I am confident that I am incapable of offering, designating, or executing a course of lectures for the one institution differently from the other. As the best mode of enabling those mechanics, whose indignation you have endeavoured to rouse by an appeal to pride of the meanest species, to judge of the manner in which my services were tendered to the "*Gentleman's Institution,*" having no copy of my letter to the Board of Managers in which the offer was made, I will insert a copy of the resolution by which these services were accepted:—

"London Institution, Oct. 14, 1819.

"Dr. Birkbeck having obligingly offered to deliver *gratuitously* a course of lectures on Natural and Experimental Philosophy during the approaching winter season,—

"Resolved, That this offer be accepted, and that the Thanks of this Board be transmitted to him.

"ROBERT STEVENS, *Hon. Sec.*"

Of the second course, I made a verbal offer to the managers, in the same terms it is probable, from the following vote of thanks:—

"London Institution, June 18, 1823.

"SIR;—I have the honour of forwarding to you the resolution of the managers of the London Institution,—

"That the Thanks of this Board be given to Dr. Birkbeck for his *gratuitous* lectures on the History of the Atmosphere, delivered in the theatre of this Institution.—I am, &c.

"WM. HASELDINE PEPYS, *Hon. Sec.*"

The word "honorary" occurs, it is true, in the advertisement of the last course, which I did not write, but not in the prospectus (inclosed for your perusal), which I did write. Lastly, I have procured from Mr. Upcott, the assistant secretary, who only returned to town to-day, a declaration respecting this subject, which, with the former documents, will show how *gentlemen* do feel on this nice etymological point.

"London Institution, Sept. 8, 1824.

"DEAR SIR;—In reply to your inquiry, I can positively state, that in the notices of lectures annually issued by the Board of Management of this Institution, the words *honorary* and *gratuitous* have been used indifferently, as conveying *precisely* the same meaning. I must acknowledge my surprise, that any question could have arisen respecting the application of those terms, so generally acknowledged to be *synonymous.*

"I remain, dear Sir,
"Your very faithful servant,
"WILLIAM UPCOTT,
"*Assistant Secretary.*"

Of the omissions, representations, fabrications, and falsehoods, occurring in an article in your last Number, purporting to be a report of the last Quarterly General Meeting of the Mechanics' Institution, I shall send you a short account in a subsequent letter.

I am your's, &c.
GEORGE BIRKBECK.

Of the spirit in which this letter is unhappily written, we shall say but little: as it is, it is the very quintessence of propriety, compared with another letter which Dr. Birkbeck has addressed on the affairs of the Institution to the editor of a cotemporary publication (The Literary Chronicle), and which no person recollecting what Dr. B. has really done for the interests of the working classes, and who is acquainted with his many amiable qualities, can have read without feelings of pain and sorrow.* Dr. Birkbeck hints at rea-

* It is thus in one passage that the Doctor speaks of the sort of hearing we should have obtained from the Quarterly Meeting,

sons which our "recollection of the past, if not quite obliterated," will suggest, and which induce him to hope that our recent attempts to "fasten inconsistency" upon him, have been "the result of accident rather than design." We know of no reasons—our recollection of the past supplies us with none—which should induce us to be *designedly*, less sparing of the truth towards Dr. Birkbeck in his public capacity than towards any other individual. The first knowledge we had of Dr. Birkbeck arose out of the invitation which we addressed to the mechanics of the metropolis to form an institution for the acquisition of scientific information, after the manner of that established in Glasgow. In common, we believe, with the public at large, we were then wholly ignorant that the institution which we were holding up for imitation, traced its origin to the exertions which Dr. Birkbeck had made about twenty years before, to extend the benefits of scientific instruction to the working classes in Glasgow. Dr. Birkbeck, immediately on perusing our address, sought an interview with us, in order to acquaint us with his merits, and at the same time to offer his active co-operation in forming the projected London Institution. He showed us documents which fully satisfied us that to him and no other the honour belonged "of unfolding, first of all, with the commencement of the nineteenth century, the Temple of Science to the artisan;" and our pages bear witness that we were not slow in pointing out to the working classes, and to the public at large, where their debt of gratitude for this great service remained to be paid. Nor is it in the power of any thing that Dr. Birkbeck, in the pettishness of a weak temper, can now say, to make us regret that we lost no occasion to impress on the mechanics of Great Britain, that they "must ever look up" to Dr. Birkbeck "as their first and best friend, and the author of whatever good they may derive from the establishment of schools for their instruction in the Arts and Sciences" (p. 178, Vol. I). We spoke but as truth and feeling dictated on the occasion; and instead of appealing to such recollections of the past, as being in discordance with the line of conduct we have recently pursued, we think Dr. Birkbeck might have discovered in them, reasons for believing, that nothing but a very imperious sense of duty could have induced one who had been so prompt and fervent in the praise of Dr. B.'s former doings, to sound a different note with respect to those later proceedings, in which, as President of the London Mechanics' Institution, he has participated. We have never had any *personal* difference with Dr. Birkbeck, and nothing is more foreign to our breasts than a feeling of animosity towards him; neither have we arraigned him individually, but in common with the other members of the Committee of Management, whom we leave to apportion among themselves the shares in which they have respectively contributed to the decline of the Institution. It is on public grounds entirely that we have opposed ourselves to the party with whom Dr. Birkbeck seems not averse to be identified; and it would be well if the Doctor would in future meet us on these grounds alone, instead of indulging in such personal allusions and verbal impertinences as disfigure his present letter. "You must remember," he says "(*for if I mistake not you still continue keenly to feel*), that the first Committee which was appointed refused to have an *honorary secretary*. And allow me to ask, if you

over which he *presided*; more than confirming, by-the-bye, all that we have said of the spirit by which certain *managing* members of the Institution are actuated. The Doctor is alluding to a charge brought against him by the Editor of The Literary Chronicle, of acting with partiality in the chair, and being a mere bottle-holder to his party:—

"If, as you say, in plain English (which, by-the-bye, you are not much accustomed to use) they (the Editors of the *Lit. Chron.* and the *Mech. Mag.*) had not preferred the secure recesses of Paternoster Row to a public meeting, judging from the feelings which were there manifested in regard to the said great personages, my services *might have been required in other offices than those which you have assigned to me*" !!! Other offices! Who can doubt what offices the *Doctor* means? Plain English this with a witness.

had been appointed to this anticipated office, as you expected, and as for the benefit of the Institution you ought no doubt to have been, did you not expect the services of the honorary secretary to be really gratuitous, or should we not expect the services of the gratuitous secretary to be honorary also?" The *argumentum ad hominem* here employed by the Doctor, is evidently made use of, less for the purpose of vindicating the system of gratuitous instruction, of which it affords *no* vindication (there being no analogy whatever between any service which an honorary secretary can render in the way of advice and direction, and the laborious duties of a professional lecturer); than with the view of casting suspicion on the motives by which we are actuated in our attacks on the Committee. The Doctor cannot—at least he attempts not—to refute what we have so often urged as to the impolicy of instructing persons, who are not paupers, gratuitously; but he endeavours to evade its application by insinuating that there must be something *wrong* in the motives which have made us advocate what is *right*. Is this fair or manly? Is it worthy of an individual filling a situation which *should* be so respected and honoured as that of President of the Mechanics' Institution? As to the matter of fact alluded to, we can tell Dr. Birkbeck, that never was individual more mistaken than he is, both in his premises and his conclusion. It is *not true* that "the first Committee which was appointed refused to have an honorary secretary," no such appointment having ever been proposed to them. To a sub-committee of five, appointed to draw up the code of laws, it was, indeed, proposed that there should be such an officer; and Dr. Birkbeck can perhaps explain from what cause it arose—whether from want of firmness, or want of solicitude for the interests entrusted to his charge—that though he agreed entirely with Messrs. Robertson and Hodgskin in thinking that such an appointment would be for the benefit of the Institution, he suffered the proposal to be overruled by a minority of two, who happened to be of a contrary opinion. Either Mr. Robertson or Mr. Hodgskin would have renewed the proposal to the General Committee, had they not felt that, coming from them, it would have exposed them to the very suspicion which Dr. B. is now so generous as to impute to them, of being actuated by personal views in the matter. As it was, no such proposition was ever made to the General Committee; and the refusal which we are said "still keenly to feel," *never was made*.

Having cleared the subject of this rather extraneous matter, we may now be permitted to ask what it is Dr. Birkbeck has disproved by his present letter? Is it that his lectures to the London *Gentleman's* Institution were *not* styled in the advertisements of that Institution *honorary*, and those delivered to the London Mechanics' Institution *gratuitous*? No—for the one fact is admitted, and the other not denied, but that Dr. Birkbeck himself had no hand in so designating them. Now, if our readers will refer to our statement on the subject, they will see that we did not aver that it was *Dr. Birkbeck* who gave them these contrary designations. We merely stated, in general terms—what we are in a condition to prove is the fact—that in the one case the lectures have been styled *honorary*, and in the other *gratuitous*; by whom, or through whose agency, we did not say, for we knew not.

The anxiety which Dr. Birkbeck displays in the first part of his letter, to repel the charge of having styled his lectures to the Mechanics' Institution *gratuitous*, contrasts, after all, rather inconsistently with the novel discovery which he promulgates in the conclusion that *gratuitous* and *honorary* mean precisely the same thing. It is thus, at least, we are assured that "*gentlemen* feel on this nice etymological point"—a sneer, by the way, at the conceptions of humbler people, which comes with peculiar grace from the President of the *Mechanics'* Institution. *Gentlemen* they may be, in point of wealth and rank, who thus confound these terms; but that they possess the education and feelings which combine to form the character of the accomplished gentleman, we must be allowed to doubt. *No gentleman* who has acquired a proper knowledge of his mother-tongue, or who has a just sense of independence, could possibly employ terms of such opposite derivation and meaning as *honorary* and *gratuitous* in the same sense. Even in popular acceptation, there is a broad and marked distinction between them; nor is it *true*, though Mr. Assistant-Secretary Upcott has been pleased to certify to the contrary, that they are "generally acknowledged to be synonymous."

Dr. Birkbeck promises us, in conclusion, another letter on the "omissions, representations, *fabrications*, and *falsehoods*," in our account of the last Quarterly General Meeting. Dr. Birkbeck is of course aware, that that account was not drawn up by ourselves, but furnished by some other member or members who took notes of the proceedings for us; and knowing this, the Doctor might as well have qualified his expressions; for as they stand, it seems as if Dr. Birkbeck had dared to address us personally in language *which he dare not use*. We invite the Doctor to the proof of his assertions; for at present, such is our reliance on the fidelity of our informants, that we should as soon expect to see the Doctor's next epistle free from every thing rude and scurrilous, as to find their report disproved in a single particular.

QUADRATURE OF THE CIRCLE.

Q. Y., on the quadrature of a circle, in No. 44, presents his thanks to E. W. S. for his clear and simple description of what is meant by *mathematicians* by the terms "squaring the circle:" the whole of E. W. S.'s explanation, in No. 47, is exactly what was wanted for the major part of the readers of the Mechanic's Magazine. Q. Y. begs leave to apologize for having made his request in such terms as appear to have made E. W. S. uneasy, for he had no such intention; and Q. Y., on perusal of his paper, cannot perceive what E. W. S. "condemns as acrimonious" in it.

Q. Y.

QUODLIBET'S PROBLEM.

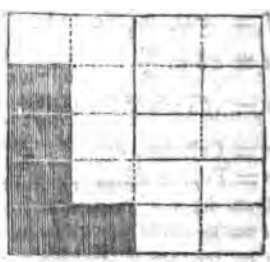
July 26, 1824.

SIR;—I was rather surprised this day, on receiving No. 48, to find the notice subjoined to my solution to Quodlibet's Problem.

Now, whether he has shifted his ground for the sake of puzzling your readers, or is in earnest, when he says, "he *thinks* it impossible to divide three-fourths of a square into five equal and similar parts," I do not know; but of this I am *certain*, that, with but a slender knowledge of geometry, it is possible, not only to divide three-fourths of a square into five equal and similar parts, but into any number of such parts.

I send you one solution of this problem, which I consider as proposed anew, and much wish that Quodlibet would himself favour me with the solution, when the parts are *six* instead of *five*; and as I *know* it possible, having effected it, he will, perhaps, favour me with his method; and also I would propose, for the ingenuity of your correspondents, to show a general rule how the same may be effected, when the parts are any number at pleasure.

I need only say that the following figure divides the square as required; the dotted lines show the number of squares the original is divided into, as in my former solution, and the shaded part is a quarter of the whole square.



N.B.—The solution may be effected in a variety of other ways; but this is sufficient to show the possibility of the construction.

G. A. S.

STEAM-ENGINE POWER.

August 16, 1824.

SIR;—In the course of my employment I have had an opportunity of conversing with several practical engineers and good mechanics, and some of them men of tolerable education; and not one of them could calculate the power of steam-engines in horses' power. It is certainly a very vague expression of power, on account of the different degrees of horses' strength, and will remain so until we assume a number (from experiments) to express the medium power of horses, which has been said to be equal to 32,000 lbs. avoirdupois, raised one foot high per minute. If the results from different experiments had been alike, a constant number would have been established, and no doubt generally known to practical engineers. It was on this account, and with a view to excite an elucidation, that I gave my former letter, with a general rule for calculation.

I cannot spare time, nor am I disposed to argue with your correspondents; I can therefore only say, that the calculations in my former letter were made up hastily, and intended for "pumping engines," not connected by a crank.

The power of steam-engines, with double power, *i. e.* piston acting with about 200 or 220 feet per minute, is said to be as follows:—

Diam. of Cylinder. Inches.	Frictional Number for the Piston.	Horses Power for 8 Hours.
12	·70	4
16	·75	8
18	·76	10
20	·78	13
24	·80	20
30	·83	40
36	·86	60
40	·87	80

J. K., a Man in the Moors, will find these frictional numbers tolerably correct, if multiplied by the area of the piston. He says, "every one knows that $\frac{1}{3}$rd is lost by the crank." I would ask him, if $\frac{1}{3}$rd is a constant quantity? I think he will find $\frac{1}{3}$rd to be too much allowance in all engines whose cylinder exceeds 30 inches diameter.

The following theorems (my own composition) will be found well adapted to practice:—

a = No. lbs. the square inch $= \frac{z}{c}$ = effective pressure.

s = ·7854, the Number to find the area.

i = 359, the No. to find the ale gallons.

f = 293, the No. to find the weight of a column of water in lbs

$z = as = \frac{w}{c^2}$.

$b = \sqrt{a \times 2{\cdot}304} = 4{\cdot}0158$, if $a = 7$, and $= 4{\cdot}8$, if $a = 10$.

c = Cylinder's diameter in inches.

p = Pump's diameter in inches.

D = depth of pit in feet.

l = length of the stroke in inches.

n = number of strokes per minute.

g = No. ale gallons per stroke.

m = No. ale gallons per minute.

w = No. lbs. weight, the power of the cylinder.

Then will

1	$c = \sqrt{\frac{w}{z}} = \frac{\sqrt{d} \times p}{b}.$
2	$p = \sqrt{\frac{g\,i}{l}} = \frac{c\,b}{\sqrt{D}} = \sqrt{\frac{m\,i}{n\,l}}.$
3	$D = \frac{w\,f}{p^2} = \left(\frac{c\,b}{p}\right)^2$
4	$g = \frac{m}{n} = \frac{p^2\,l}{i}.$
5	$l = \frac{m\,i}{n\,p^2} = \frac{g\,i}{p^2}.$
6	$n = \frac{m}{g} = \frac{m\,i}{p^2\,l}.$
7	$w = c^2\,z = \frac{p^2\,d}{f}.$

The above formulæ are answered at sight upon the improved sliding rule, thus:—

A	1·274.
B	No. lbs. working pressure.
C	No. lbs. power of the cylinder.
D	Diam. cylinder in inches.

A	293.
B	Feet depth of pit.
C	No. lbs. power of cylinder, or weight of water in pump.
D	Pump's diameter in inches.

I could wish to see a table in the following form by some correspondent:—

Load on the Safety Valve, per square Inch.	Temperature, Fahrenheit.	Pressure of Steam on the Piston.	Quantity or Expense of Fuel.	No. Times Steam could expand itself to the same Volume, and continue equal in Elasticity to the Pressure of the Atmosphere.
lbs.	°	lbs.		
0	212	14	1	
1				

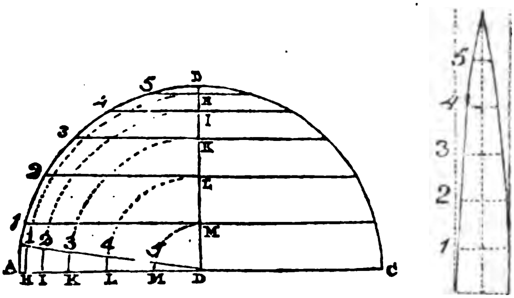
I remain, Sir, your well-wisher,
William Andrews.

MODE OF CONSTRUCTING MONTGOLFIER BALLOONS.

Leinster-street, Dublin,
June 13, 1824.

Sir;—I am one of those who still hope that the science of aërostation, although nearly fifty years old, will, at some period, attain a state of manhood, and emerge from its present one of infantile amusement. I perceive, in your 41st Number, an article headed "Balloon Governor," which induces me to send you an account of an experiment on a nearly similar principle, which had nearly saved the late Duke of Orleans from his subsequent melancholy fate about the year 1784 or 5.—[The narrative of our correspondent being similar to that already furnished by Mr. Marsh, p. 266, is here omitted].

Being on this subject, for those who amuse themselves by making small "montgolfiers," I send you a plan by which they may be constructed of any size (correctly globular), which I do not find to be universally known. A. H. R.



Description of the Figure.

Draw the semicircle A C of the intended diameter of the balloon; bisect it by the line D B. Divide each of the arcs A B and A C into six equal parts; join those points by lines parallel to the diameter, and marked H I K L M. Bisect the arc of the semicircle marked A 1, and draw a line to the center D; with one leg of the compasses at the center D, draw the concentric reduced circles, as H I K L M, marking the portion of each, included within the legs of the angle A D E.

Draw the auxiliary parallelogram G D, whose height is to be the quarter of the circle, and whose base the sixth part. Divide into six parts by lines parallel to the base. Transfer to these lines on each side of the centre, the length of each of the reduced circles, according to letter and number included between the legs of the angle A D E, and the slope proper for a balloon of that dimension will be found to pass through those points.

TAPPING NUTS.

Sept. 1, 1824.

Sir;—If you have a spare corner in your much-esteemed and valuable publication, be kind enough to insert the following simple method of tapping a large sized nut with a smaller sized tap. I know not whether the plan has originated with me (that is of small moment), but I believe it is not generally known, having much astonished my own men by the performance. The method will be found of particular benefit to those who have not a good selection of screwing apparatus. Suppose, for instance, a workman has to tap a one-quarter inch nut, and has a taper tap, whose greatest diameter is only one-eighth inch. Let him insert with the tap an iron wedge, five-eighths wide and three-eighths thick at the largest end, and work down the tap as usual; the back or part of the wedge nearest the outside of the hole accommodates itself to the thread, which the tap forms and moves round with it, leaving as excellent a thread as a tap would of the proper size. Your's, &c.

T. G. D.

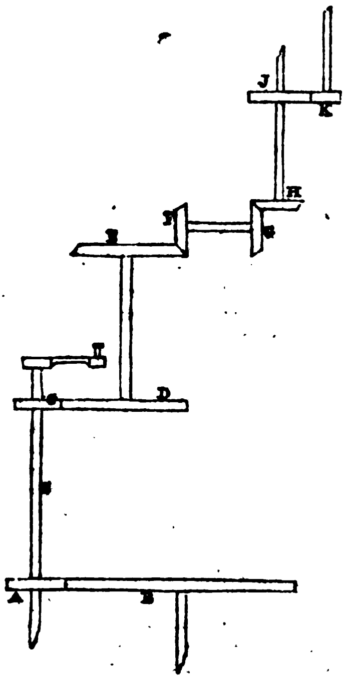
REVOLUTION OF COG-WHEELS.

Hawarden, April 9, 1824.

Sir;—In reading your valuable Magazine (No. 16), I saw a problem by R. G. respecting the number of times the starting-teeth of two wheels would revolve before they came in contact a second time. I consider R. G.'s wheel of 43 cogs would revolve 127, and the wheel of 127 cogs would revolve 43 times. I hope R. G. will excuse me for connecting the following wheels to his in the situation under-described; and I shall be obliged to him, or any of your correspondents, if they will inform me how many revolutions each wheel goes before it come in the same place from whence the first began to move, including R. G.'s wheels.—I remain, Sir,

Your most obedient servant,

J. H.



N, a crank, driven by steam, or any other power; S, a shaft; A, a wheel, with 43 cogs, working in B, of 127 cogs.

C, a wheel of 28 cogs, working in D, of 66 cogs.

E, a bevel wheel, 60 cogs, working in F, of 28 cogs.

G and H, a pair of mitre wheels, of 30 cogs each.

I, a spur wheel, of 47 cogs, working in K, of 11 cogs.

BOAT FOR PASSING UP RAPIDS.

26, Dean-street, Soho.

Sir,—In No. 5 of your valuable Magazine, I find a notice of a discovery made in America, to make a vessel advance against a strong current. But this same discovery, which is more particularly described in your Magazine, was made by me so long ago as 1816, in St. Petersburgh, where I then resided; and the drawing, with a circumstantial description, was presented to General Devoland, at that time chief of the department, superintending the inland navigation of the empire, and is in the archives of that department. Though this invention of mine might be of considerable utility in Russia, no application, as far as I know, has yet been made of it. It has the peculiar and remarkable property, that the more strongly the current cuts against the vessel, the more rapidly does the vessel ascend against the current; and, by the use of it, it is possible to advance very rapidly against strong currents, which no steam-boat would be able to overcome. Since that time I have made many important improvements in this discovery. Should any person be disposed to make use of this invention, and apply to me on the subject, I will communicate to him all the particulars. I have likewise succeeded in making several other discoveries, which, however, are far more important to England than the preceding; for which, as I have now completed them I intend to take out patents.

Charles Harsleben.

HOUSING SHIPS.

To the Editor of the Mechanic's Magazine.

Sheerness Dock-yard.

Sir,—Amongst the causes stated as likely to favour the production of the dry-rot in ships, has the present mode of ship-building been included? In former times vessels were laid down, run up, and finished under exposure to every change of weather; the timber was, as it were, left familiar with the elements, by which it had always been surrounded. Now-a-days rain and sun, dryness and moisture, are alike carefully guarded against by immense plank roofs and canvas drapery, and yet this dreadful scourge is more active than formerly.

It may aid the solution of this question to state, that it is ten years since the first ship was covered in this way, on the suggestion of Mr. Southby.

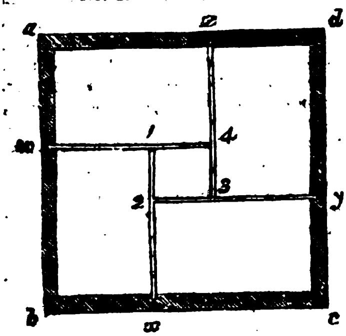
A Caulker.

THE IMPROVED WIRE GAUGE.

"A Subscriber, R. B." writes to us in these terms: "The Improved Wire Gauge, I beg to observe, is not a new invention, as I have had one on the same principle, viz. the combination of two straight edges, but of superior construction, in constant use about nine years, of which, if worth your notice, I will send you a description."—We shall be glad to receive the description.

ANSWERS TO INQUIRIES.

No. 45.—FLOORING.



Stepney, July 26, 1824.

Let *a b* represent one side of the square tower = 18 feet, and *w* 1 4, *x* 2 1, *y* 3 2, *z* 4 3, represent the four joists = 12 feet. Then if *w x y* and *z* be added in the wall at the distance of 6 feet 6 inches from *a* to *w*, from *b* to *x*, from *c* to *y*, and from *d* to *z*, with a mortise and tenon at 1, 2, 3, 4, the floor, as it seems to me, will be very strong, and, perhaps, the strongest possible.

By placing the joists 6 feet 6 inches from *a b c* and *d*, it will allow 6 inches of each joist to be bedded in the wall.

W. P., *neither Carpenter nor Surveyor*.

Another Answer.

SIR;—In answer to your correspondent "G. W." respecting his query on "flooring a large place, with timber too short to reach across it," I reply, that the case he has given for consideration, once occurred to Inigo Jones. I do not know, however, how he placed the beams of timber, but conceive that if they were put as in the annexed drawing,* they would form what is required, a perfectly level floor, without any upright support under it, and as strong as possible with timber of that description. It is evident that no boards will be required to cover it more than twelve feet long.

G. FRANCIS, JUN.

* The same exactly as that furnished by our other correspondent, W. P., and given above.—*Edit.*

HAND CORN-MILLS.

Whitechapel, Aug. 24, 1824.

SIR;—Your correspondent, in Inquiry No. 60, in the 52nd Number of your interesting Magazine, desires to be informed if *hand corn-mills* are made for sale? He is informed, that Robertson's Improved Portable Corn-Mill may be purchased at the manufactory of Schooling & Co., No. 14, Great Garden-street, Whitechapel. The whole apparatus is contained in an iron-case about twelve inches long, eight broad, and nine deep; and by means of it one man will grind as much flour in three hours as a family of six persons consume in a week. Portable machines for dressing flour are sold separately. These mills will also crack malt, pease, and beans, grind rice, and every sort of grain, coffee, pepper, &c.

Your obedient servant,
SCHOOLING & Co.

Turnmill-street, Clerkenwell, August 23, 1824.

SIR;—In answer to the Inquiry No. 60, I would recommend your correspondent to the shop of Mr. Henry Marriott, 89, Fleet-street, where he will find such a "hand corn-mill" as he requests, viz. one simple in its construction, and taking up but very little room, and likewise capable of doing all the work which he intends to do.

Your most obedient servant,
A Mill-Maker.

[A plan and description of a Portable Hand-Mill, received from W. H——s, of Chatham, is in the hands of our engraver, and will have an early place.—EDIT.]

GOLD AND SILVER.

Prideaux says, that gold and silver were much more plentiful in the time of David and Solomon, and for 1,500 years afterwards, than they are present; and that the mines of Arabia being exhausted, and the gold and silver with which the world abounded being wasted by the barbarians, the mines of Mexico, Peru, and Brazil, have not been able to repair the loss.—He mentions two or three instances of the vast riches of private men in ancient times. Pythias, the Lydian, possessed gold and silver to the amount of nearly five millions sterling. Marcus Crassus, the Roman, after feasting all the people of Rome at 10,000 tables, and giving every citizen corn enough to last him three months, found the remainder of his estate to be equal to about 1,400,000*l.* Lucullus, a Roman senator, used to expend 50,000 denarii (1,400*l.*) every time he supped in his hall, Apollo, and this was as often as any of the better sort supped with him. It has been computed that Nebuchadnezzar's golden image, and the various other images, utensils, &c. of gold, in the temple of Belus, at Babylon, amounted in value to about 34,000,000*l.* Vast loads of gold and silver were often carried in triumph before Roman generals, when they returned from conquered provinces. The gold with which Solomon overlaid the *most holy place* only, a room 30 feet square, amounted to more than 38,000,000*l.*

Crito, a writer in the Christian Spectator, supposes also, that the amount of wealth was formerly much greater than at present. He notices the following instances:—the Israelites, soon after their escape from Egyptian bondage, offered for the tabernacle gold and silver to the amount of 170,000,000*l.* (Exod. xxxviii. 24, 25). This was probably borrowed of the Egyptians; but it shows that gold and silver were plenty in Egypt. The contributions of the people for the sanctuary, in the time of David, exceeded 6,800,000*l.* (1 Chron. xxix. 7). The sum which Haman offered Ahasuerus, on condition of being permitted to order the destruction of the Jews, was 10,000 talents of silver, or 340,000*l.* (Esther iii. 9). The immense treasure David is said to have collected for the sanctuary (1 Chron. xxii. 14), amounted to 889,000,000 of pounds sterling (Crito says 798,000,000, but erroneously), a sum greater than the British national debt, and exceeding all the money coined since the discovery of America. It is supposed by some learned men, that David never amassed such an immense sum, and that an error has been made by the transcribers of this book. Prideaux conjectures that the talents of gold and silver given by David and others for the temple, might be of another sort, of far less value than the Mosaic talents. He remarks, that if these talents are valued by the Mosaic talents, they would have built the whole temple of solid silver.

Crito estimates the talent of silver at 342 pounds sterling, and the talent of gold at 5,475 pounds sterling, according to Dr. Arbuthnot's "Tables of Ancient Coins, &c." inserted in the translation of Jahn's Archæology.

The following is the estimated produce of the different gold and silver mines in modern times:—Of gold, the mines of Europe produce, in sterling, only 185,020*l.* Northern Asia, 76,770*l.* America the rest of the total of 2,467,260*l.* in the following proportions:—New Spain, 229,630*l.*—New Grenada, 672,500*l.* Peru, 111,530*l.* Potosi, and provinces east of Buenos Ayres, 73,180*l.* Chili, 400,550*l.* and Brazil, 980,870*l.* Of silver, the total amount of which is 7,314,670*l.* Europe produces 484,580*l.*; and Northern Asia, 199,630*l.* America furnishes the rest. New Spain, 4,945,340*l.* Peru, 1,292,440*l.* Potosi, &c. 1,019,070*l.* and Chili, 62,820*l.*

TO CORRESPONDENTS.

B. T.'s letter is in type; but the space otherwise devoted to the Institution, prevents our finding room for it this week. It shall appear in our next.

With next Number we shall publish a Supplement, to conclude our second volume. It will contain Preface, Index, and Title; and what room there is to spare, shall be devoted to the favours of correspondents.

The articles proffered by R. B. will be acceptable.

G. T.'s plan of a quadrant is among our "intended for insertion."

Mr. Jackson's volume shall be taken every care of.

S. E. is informed, that the concentrated rough pyroligneous acid may be obtained at any chemist's. It is simply vinegar extracted from wood.

Communications received from R.—G. Conway—W. Andrews—J. S.—G. I. N.—An Original Subscriber—Inquirer—A Constant Reader—Mr. Hayter—Mr. Pasley — Philo-Veritas — T. L. — Y. — John W. Hall—An Inquirer anxious to improve himself—A Naturalist—Captain Manby—W. H. T.

Communications (post paid) to be addressed to the Editor, at

THE PUBLISHERS,

KNIGHT AND LACEY,

55, *Paternoster-Row, London.*

T. C. Hansard, Pater-noster-row Press.

LONDON MECHANICS' INSTITUTION.

WHEN we last noticed the proceedings of this Institution, we were accused by its President of being guilty of various "omissions, fabrications, and falsehoods," with a statement of which he pledged himself to furnish us "in a subsequent Letter." We stated in reply, that the notice (as Dr. Birkbeck was perfectly aware) was not drawn up by ourselves, but that such was our reliance on the fidelity of our informants, that we could venture to challenge the Doctor to disprove their report in a single particular. This was as far back as the 18th of September last. On the 16th of October we took occasion to remind Dr. B. that though four weeks had then passed away, our challenge remained unanswered—his own voluntary pledge unredeemed—and we submitted, whether under these circumstances we might not take it for granted that he found he had asserted *what he could not prove*. The worthy Doctor was here fairly warned of the sort of judgment which would be entered up against him, if he still failed in making good his charge; but though six weeks more have elapsed (26th November), the matter rests just where it did. Every reasonable person, we think, will agree with us, that it is now high time the case should be closed; our pages cannot remain for ever open to discussions of this sort. The long silence of Dr. B., after being so challenged, and so admonished, speaks eloquently enough to warrant us in coming to the final conclusion, that he has indeed asserted what he cannot prove—brought charges of a foul and calumnious nature which he has no means of substantiating.

How far it is consistent with the grave dignity which should belong to the office of President of a public body, or with private respectability of character, thus to scatter injurious imputations, and then to shrink from the proof of them, we leave every one to decide for himself. We are content to have placed the facts of the case fairly before our readers, and now take our leave of the subject for ever.

We have now to revert to what we said, also in our last notice of this Institution, of its Committee of Managers. We showed (p. 436—438) that by a deliberate infraction of the laws of the Institution, at the last election, the working classes had been deprived of the number of votes in the Committee which these laws professed to secure to them, and that one of the *extra* gentlemen *(ex uno disce omnes)* thus thrust into the management, had accomplished the trick, by passing himself off as *a common workman*, though, in reality, a master tradesman at the head of a large establishment.

Neither of these statements—neither the infraction of the laws, nor the imposture by which it was assisted—has been denied by the Committee, or by any one;

in the course of the ten weeks which have since elapsed. It stands confessed that, as now constituted, the Committee of Management is an illegal usurpation, elected contrary to the laws, and acting in defiance of them.

Nay, so far has even their respect for appearances vanished, that the gentleman who in the balloting-list passed muster as one of "the working class," and was elected as such, has assumed in the subsequent *official* lists of the Society, the title of "Francis Place, jun. *Esquire!*"

The parties inculpated by this flagrant departure from the laws of the Institution are not only those who have usurped the seats designed for working mechanics, but all who promoted that usurpation, or who have since sanctioned it by acting with the individuals illegally elected, from the eloquent and enterprising president, down to the most silent and quiescent committee-man amongst them. We may be wrong in our notions, but it does appear to us, as if the case were one, with which no person of correct principles, and animated by a sincere friendship for the working classes, could possibly wish to be identified.

We had written thus far when we received the following *Letter* :—

"London Mechanics' Institution, 29, Southampton-Buildings, Holborn, 25th Nov. 1824.

"SIR;—I am desired by the Committee, most respectfully to inform you, that the first stone of the New Theatre or Lecture-Room adjoining these premises will be laid by Dr. Birkbeck on Thursday next, the 2nd of December, at *Three* o'clock *precisely*, on which occasion they hope to be honoured with your company; and also at the first Anniversary Dinner of the Patrons and Members of the Institution, which will take place at the Crown and Anchor Tavern on the same day at *five* o'clock *punctually*. The Dinner Tickets will be Six Shillings each; and should it not be convenient for you to attend, an answer to that effect will be esteemed a favour. I remain, Sir,

"Your very obedient Servant,

"Mr. Robertson." "JAMES FREDERICK BLAKE, Hon. Sec."

The following Answer was returned :—

"28, Bennet street, 29th Nov. 1824.

"SIR;—I regret that I cannot, in consistency with the opinions which I have publicly expressed of the conduct of the Managers of the London Mechanics' Institution, and which to this hour remain wholly unchanged, accept of their invitation, to attend at the laying of the Foundation Stone of the New Lecture-Room, on the 2nd of December next, or at the subsequent Anniversary Dinner of the Patrons and Members of the Institution.

"I have, at the same time, to express my sense of the polite terms in which the invitation of the Committee has been conveyed. And remain, Sir,

"Your most obedient Servant,

"J. C. ROBERTSON."

From the share which the Mechanic's Magazine had in originating and promoting the Establishment of the Mechanics' Institution, it must be obvious to every unprejudiced person, that did its Editor consult only his personal inclination, and perhaps interest, he would do his best to hold the Institution up to the public, as answering every expectation that had ever been formed of it, and that nothing but a strong sense of the impossibility of doing so with sincerity and truth, can have induced him to adopt the course he has done, and to which he adheres with unfeigned reluctance. It has been said, that he has a private pique to gratify. But said by whom? By those who can make *no other answer* to the charges of misconduct which he has brought against them. If these charges were either so trivial, or so groundless as to occasion wonder, that any one could advance and persist in them, there might then be some reason for suspecting the existence of some improper feeling; but when they are such as regard the very existence and well-being of the Institution; when they have not once been denied, or attempted to be refuted; when they furnish of themselves so ample (too ample) a justification of the course the Editor has pursued; he feels that he needs be under no concern as to what exposed delinquency may choose to assert of his motives. This only he will say for himself; he loves right so much better than resentment, and prizes the interests of the working classes as involved in this Institution, so far beyond all personal or party considerations, that the Managers have never had that arrow in their quiver, which could provoke him to sacrifice either.

In neither of the events announced in the Secretary's letter, does the Editor perceive the smallest ground for congratulation.

The foundation stone which is about to be laid he regards as but the foundation of a load of debt (for the proposed building is to be erected by means of borrowed money) which the prospects of the Institution do not warrant the Managers in contracting, which the members at large have never regularly and deliberately sanctioned, and which may tend to place the Institution in a state of dangerous subserviency to the individuals who may choose to constitute themselves its creditors.

The Anniversary which the Managers and their friends consider a fit subject for convivial celebration, brings to the Editor's mind only cause of sorrow for principles abandoned, laws and promises broken, and great interests lamentably sacrificed.

The Institution was founded for the benefit of the journeymen Mechanics of London chiefly, who showed, by the numbers in which they flocked to its first meetings, that they were fully sensible of the important benefits which it promised to procure for them; but so slowly and imperfectly have the plans laid down been followed, and so little has the year produced, suited to the wants and taste of the journeyman mechanic, that the number of this class now enrolled as members, has dwindled to a few hundreds, of whom a large proportion are new intrants, who, if we may judge from the past, have entered only to acquire that experience of empty professions, which has disappointed and driven away their predecessors. The number of members altogether is small, and certainly not more than one *half* are of that class of persons for whose special benefit, the Institution was founded.*

The Institution was established, too, on the condition that the mechanics themselves should have, in the proportion of two-thirds, the preponderance in the management of its affairs; but that condition, as we have seen, has been shamefully violated.

It was provided, also, that the Institution should rest on the principle of self-support and exertion. The Mechanics of London would have disdained to seek advantage from it on any other. But, though the rate of contribution to the London Mechanics' Institution is higher than to any similar Institution in the kingdom, it cannot (it is believed) be said, that one penny has yet been paid for lecturers or teachers. The Managers have proceeded on a system of begging for gratuitous instruction, wholly inconsistent with that spirit of independence which breathed in the first resolutions of the Society, and, in our humble opinion, most injurious to the real interests of the working classes. Who can doubt that it is partly owing to an honourable repugnance to instruction on such terms, that so few mechanics are now to be found in the list of members?

The Institution, in short, has become a Mechanics' Institution only in name. It may possibly yet flourish as a school of science for persons of a higher order; but it is a sort of fraud on public credulity, to which the Editor of the Mechanic's Magazine would be ashamed to contribute, to call that any longer the London Mechanics' Institution, which, out of two or three hundred *thousand* London Mechanics, boasts of but two or three *hundred* on its roll, which is governed by a Committee, but few of whom are of the class of London Mechanics, and which, in all its transactions, shows an utter want of that workmanlike energy and independence by which the Mechanics of London are so honourably distinguished.

Nov. 28, 1824.

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* The Editor makes these statements, partly on the strength of what he has himself observed, and partly on the admissions of the Secretary of the Institution. Should the Managers dispute their accuracy, they have in their hands an easy means of rectifying them. Let them order a return to be made up from the books, of the number of working mechanics who were enrolled at the commencement of the Institution, and the number who are now enrolled; as also a return of the number of present members of this class, who were members a twelvemonth ago.

INDEX:

VOL. II.

A.

B.

C.

INDEX.

INDEX.

K.

L.

R.

S

T.

U.

V.

W.

A PAPER

SHOWING THE

USE OF THE SPLEEN:

SHOWING ALSO

THE USE OF THE RESPIRABLE ELEMENT

OF THE

AIR TO THE BLOOD.

BY

T. H. PASLEY.

He who does not understand MOTION, is necessarily ignorant of all things. ARISTOTLE.

" No THEORY OF NATURE is otherwise than false, which has not for its basis the INERTIA OF MATTER."

JERSEY:

PRINTED AND PUBLISHED BY P. PAYN.

1839.

THE USE OF THE SPLEEN IS TO PROMOTE THE MOTION OF THE DIAPHRAGM.

THE USE OF THE RESPIRARLE ELEMENT, TO THE BLOOD, IS TO PROMOTE THE SYSTOLE OF THE HEART.

The Author is not one of the Faculty—he trusts his mistakes will be overlooked. His object is to exemplify further, and firmly establish the THEORY OF MOTION already published.*

* See Pasley on Perception, Optics, Pressure and Motion.
Whittaker, London.

A PAPER.

SHOWING THE USE OF THE SPLEEN.

&c. &c. &c.

That the use of the spleen has remained undiscovered to this day, is owing to Philosophers being so tenaciously wedded to their favourite but irrational principle—*attraction*, a principle, which, although repugnant to the *inert* nature of matter has been universally adopted; but its adoption has prevented mankind from viewing in a simple mechanical light, the true procedure of nature, the theory of which is deducible from the fundamental principle *Inertia*.

As the rational and consistent philosophy, founded on THE INERTIA OF MATTER, must be vastly different from the system which arbitrarily assumes that Matter is not inert but can act of itself—that is, can *attract* and *repel* its like: so, before the final adoption of either, the question should be agitated and decided, whether Matter be inert or not, whether it be active or inactive. If it be *inert* it can do nothing, neither attract nor repel; it is *cause* in no instance, and to it no *effect* whatever can with reason be imputed. On the other hand, if Matter can attract and repel its like, it is an *acting cause*, it is not inert.

It may however at once be reasonably presumed that Matter, from consisting in unorganised atoms of mere brute atomic substance, and each atom, from being in itself unity of substance, is devoid of every thing like a *self-acting property*—a property possessed by nothing without organisation and vitality,—rather than it should be maintained in the face of common sense that every atom in creation can act in a twofold manner, that each should constitute not one, but two *physical* powers; by which there would be double the number of powers or forces, to keep the system of nature in motion, as the system contains molecules of matter. And while these universal means for carrying on the system are assumed, it cannot be denied the existence of a third universal power, *uni-*

versal pressure; which, in fact, makes the other two superfluous : for any thing like this triplicity of *universal* causes, is opposed to all correct ideas of *simplicity* ; a principle closely followed up by all who may be concerned in mechanical practice and certainly most undeviatingly maintained throughout. the sublime performances of Him whose omniscience is conspicuous in all his works ; from the whole of which we learn, that to be simple the fewest causes, even to unity of cause, and shortest means, should be sought after and direct our opinions in the lofty pursuit after the truths, not secrets—for if not all, there is nothing secret—of Nature.

Were attractive and repulsive properties possessed by matter, as being elementary properties, they could not be either communicable or removeable, but must be identified with the substance of matter : whereas we make iron and steel magnetic and unmagnetic, "attractive and unattractive," Nor is there anything to which these properties are attributed, even the magnet and loadstone, but, by means of fire, can be shown to be possessed of nothing of such imagined elementary properties, And notwithstanding attraction by inert atoms, and by bodies formed of such, has been countenanced for centuries, *there is not in all Nature one single instance* DEMONSTRATIVE *of the assumption being true.* Besides, as all phenomena attributed to these occult powers, from consisting in effects and results produceable by pressure, indicate that nothing more is wanting to cause them than physical impulse, so is pressure not only an analogous, but a competent cause for the production of the whole.

Although all Nature is in motion, and is throughout in an acting state, yet no part acts or moves itself; part is impelled by part all through, as if the whole were cause of every occurrence, and of every change: as if the whole pressed or were pressed forward as cause in every instance of local change. Now, were matter not *inert*, of what use is this general pressure, for the production of local change. Could every atom by attracting move every other, so would every-body find cause of motion in the attraction of some other body: but what then could ensure direction or order of motion; and *could* matter at the same time repel, of what use would be attraction. On the other hand as motion universally needs for cause that which is truly universal, of a physical nature and analogous to the physical effect motion, so from existing pressure answering the whole of these conditions—for as far as motion extends, there must be a physical impelling cause—it may with reason be concluded that the state of pressure under which all things exist, has been designed to be the *Universal Cause*, and this in consequence of the inactivity, the inertia of matter. Existing Pressure, effects every thing erroneously imputed to the occult properties, attraction and repulsion; and would have a useless existence were not matter devoid of the power of action, or were it not *essentially inert*. The foregoing general heads admit of the following arrangement, which it is necessary here to set forth as being illustrative of the cause of motion generally, therefore of the motion of the diaphragm which the spleen promotes.

Matter consists of atoms or molecules, and of such are all manner of bodies constituted.

Matter being *essentially inert*, neither in the elementary nor bodily state is it *cause* or can it produce any kind of effect whatever. Inert matter acting, attracting and repelling, is as irrational as dead men walking, and as absurd as the right leg walking forward and the left leg backward, at the same time.

NO THEORY OF NATURE is otherwise than false which has not for its basis the INERTIA OF MATTER.

The atoms of matter are unalterable: one inert atom cannot act on or alter another. The consistency of nature in all things from the beginning, evinces the unchangeableness of the materials, that is, atoms, of which the world is composed.

There is reason for assuming that the *shape* of the whole of the atoms of matter is spherical. For as inert unchangeable matter can be subject to change of place only, so to effect this *uniformly* on combined atoms, as in the expanding of bodies, there must be permanent openings in all bodies for the admission of a physical cause of separation; and the spherical shape is that only, which, while it permits immediate contact, leaves empty spaces uniformly throughout, in every kind of body, for the entrance of a physically expanding or displacing cause, without which there are no means of accounting for the expansion, decomposition, and ultimate dispersion of the elementary atoms of bodies.

Local change is that only to which bodies, formed of inert unalterable atoms of matter, can be liable by any possibility; and local change is the effect of physical impulse.

In every instance whatever the known General Pressure is the physically impelling cause: two causes to produce the common effect, motion, being unnecessary.

Essential *action* and essential *change* must be foreign to *inert unchangeable atoms.*

Cause is that which impels; it must be in motion to be in action and in motion as long as it is producing effect.

Effect consists wholly in the impulsively produced motion of that which is impelled.

Result is the altered condition of a body, after the body or its atoms have ceased to be impulsively acted on.

Rest, being a state of inaction requires no cause

Vis Inertiæ, or the force of inability, is as great an absurdity as, the *heaviness of nothing.*

Motion is the local condition of a body while the body is not allowed to remain at rest; it is the State of a Body while the body is being made to pass through contiguous portions of space.

IMPULSE *is as constant as the duration of motion*, inasmuch as effect *must* be produced by its *equal of cause*. Therefore a body is being impelled through the entire of its trajectory or of its orbit, and that which impels it is necessarily in contact with the body impelled the whole of the way.

In vacuo, as there is no impelling cause, there can be no motion ; hence in planetary motion we have reason for concluding that space is not a vacuum ; and as to keep the planets in motion, requires nothing short of a medium in a state of impulsive pressure filling planetary space, it follows that space is a plenum.

How the general pressure originated it may be impossible to say, nor has science aught to do with creative measures—still as "imagination's airy wing has always rest in view, the place however distant," we reason thus : inert matter cannot of itself act on matter, neither can it suffer change in either substance or essence : therefore the essential nature of matter cannot be cause in any instance, or concerned in the production of any phenomenon whatever, any more than from the physical nature of matter Inertia can be made cause. Immaterial cause to account for material effects is by no means maintainable. Therefore, and of necessity, we revert to existing pressure as a universal cause, and the only means consistent with the inert nature of matter.

Next, as to the origin of the phenomenon, the general pressure, there can be nothing of error introduced into science in proposing that out of the all-wise manner of putting together the parts of the system, has emanated the general, the universal motive power, pressure. Neither is it unreasonable to conceive, that, from the first this state of pressure may have been originated and may now be maintained by means of the motion into which the same pressure retains the heavenly bodies. A planet may affect the medium it is passed through, so as to form a current—as it were a gulph stream current—of that medium against a neighbouring planet; this second may do the like against a third, and so on throughout the entire circle of bodies belonging to the solar system—as, did the water displaced, lifted and forced forward at and from the bow of a ship under sail, contribute, by its forcible flow, to the continuance of the motion of a preceding ship, and this latter by its motions similarly beget a forcible flow against another remote ship, and the motion of this in like manner stir up a stream against a third ship a-head, and so on throughout a general round of vessels—to which might be added, that, as the forced up water at the bow is supposed to occasion a forcible flow from ship to ship, so may it be conceived that the depression of water in the wake of each ship, would further induce the continuance of such a circulating stream, as should keep in motion these bodies by means of the motions by which the steam itself has its motion perpetuated. On this idea cessation of motion becomes a physical impossibility, and the entire system remains self-regulating, which most probably is the state and order of the planetary system.

" In human works, though labour'd on with pain,
" A thousand movements, scarce one purpose gain,
" In God's, one single can its end produce,
" Yet serves to second too some other use—
" All served, all serving, nothing stands alone,
" The chain holds on and where it ends unknown."

Although the origin of pressure may not be discoverable, the existence, nature and effects of this source of physical power are undeniable. The origin and nature of attraction being not only unknown, but undiscoverable, as well unintelligible, has not prevented this absurd nominal from being considered for centuries a really natural physical cause.

And as to the whole amount, sum, or maximum of pressure, it is not by barometrical calculation the truth is to be ascertained, which gives but fourteen pounds the square inch as the general average. We must refer to phenomena on the largest scale, such as earthquakes, tornados, volcanic eruptions, tempests, whirlwinds, moving bogs, the great water-spout, the force of steam and water during the process of congealing—to the force necessary to effect the expansion, contraction, and tenacity of metals, to the whole of which no common cause is rationally assignable but that of pressure.

As there cannot be two causes of impulsive effect or motion, and as that by which the greater planetary motion is produced, is capable of effecting the like on a minor scale, so all motion great and small is referrible to the Medium of Space, on the pressure of which, it will be found, all atomic, equally as all planetary motion, depends. The planets float, as it were, within the Medium of Space: by it they are forced orbicularly through the same medium; and it in turn pervades every planet and every thing in the bodily form; which is owing to the atoms of matter being spherical, and the smallest possible interstices they originate, by aggregation, being too large to exclude or prevent the forcible introduction of the atoms of the Medium of Space. The exclusion therefore of the Medium of Space from the whole of the interior of bodies is a physical impossibility.

As from being composed of spherical atoms, all bodies must be porous uniformly throughout; and as from the smallest interstices of bodies being larger than the atoms constituting the Medium of Space, so may the Medium of Space within a body and within every body, be likened to the water in a submerged sponge.

Bodies of every kind must of necessity be saturated with the Medium of Space. Still the filling up or saturating quantity is not always the same in the same body, which depends on the more or less of the larger interstices being previously occupied by other elementary atoms. But under all circumstances, and be the quantity of the Medium of Space within a body what it may, it may be considered the fact, that, the portion of the Medium of Space within a body is continuous with the like medium in space generally; or that the Medium of Space is continuous from without to the very heart or centre of the densest body; consequently the force of the general pressure, or the force of the pressure of the Medium of Space, is, after this manner, carried, as it were, not only to the centre of the body, but to every elementary atom belonging to the body. By means of which each and every atom becomes moved centrifugally the instant the external pressure on the body is, as is the case in a medium of fire, reduced; this constitutes the expanding process: and the atoms of the body will be wholly dispersed, provided the medium by which the body is surrounded presents recipient interstices for the atoms of the body so expanded ; in this consists the decomposing process.

It being, most decidedly, irrational to reject the ge- eral pressure as the cause of motion universally, the ext consideration is to ascertain the means employed by Nature, for not only obtaining pressure of every degree downwards, but for subverting the equilibrium of pressure on the same body, as on this latter desideratum depends the phenomenon motion: for as equal pressure on opposite, or on all sides, of a body, retains the body at rest or does not put the body into motion, so, when we see a body in motion in the air, we have most certain evidence that the opposite sides of the moved body are pressed unequally. The question then is, what subverts the equilibrium of pressure on the body, which occasions it to be unequally pressed, therefore moved? What causes the body to be under a greater degree of pressure on one side than on the opposite; and, how is it that the maximum of pressure does not prevail in all cases: in a word, what are Nature's *minus-pressure* means?

The following instanc es, I imagine, will clearly show in what consist the *minus-pressure* means, the interposition of which reduces the full force of the general pressure on a body—by which the maximum of pressure is, as it were intercepted—also, how, by the same *minus-pressure* means, a body may be unequally pressed on different sides, therefore forced out of rest into motion.

As a vacuum, if presented to one side of a body which is at rest and under the general pressure, would cause the body to be under a less degree of pressure on that side than the opposite, also cause it to be moved by and in the direction of the greater pressure; so, but in a less degree, is the general pressure on a body reduced, when, instead of a vacuum, highly rare elementary matter covers one side of the body. When a body is wholly covered with elementary matter—as by an invisible electric atmosphere—it is under equal but reduced pressure on all sides: when it is but partially covered, it is under reduced pressure on the side which is possessed of the elementary matter; and it is put in motion in consequence of the greater pressure being on the opposite or uncovered side.

The elements of matter are the means by which the equilibrium of pressure is subverted, and as vacuity is to the rarest element, so is any one element a minus-pressure medium or means, to any other element of grosser atoms. The pressure on and within a body, is reduced proportionally to the rarity of the elementary matter attached to the surface and occupying the interstices of the body. Hence, elementary matter generally, that is, matter in the elementary state,—which, from not being cause in any instance, but only promoting means,—I have, in all cases wherein it promotes motion, designated by the appellation *minus-pressure means*.

A polished needle when dry floats, but when wetted or smoked does not float, it sinks. It is manifestly under greater pressure when it is precipitated, than when it floats. Had it an electric atmosphere round it the pressure on the needle would be less than were it not possessed of any such atmosphere. That it does possess a minus-pressure Atmosphere, when dry, is inferable not only from the reduced pressure the dry needle is under requiring some such interposing cause, but from the bed formed in the water in which the needle lies, being so much larger, every way, than the needle itself; and as the needle does not rest on, but above the water, that is above the bottom of the hollow bed, the inference is, that something as an electric atmosphere is attached to the needle, and that by this Atmosphere the water is displaced beyond the sides of the needle; and that on this electric atmosphere the needle rests. The whole of which is corroborated by the needle being precipitated at once, when wetted or when blackened with smoke, either of which, by removing the minus-pressure atmosphere, leaves the needle under greater pressure than when it was dry and bright.

All calculations on the tides, having attraction in view as cause—so much is attraction but a mere name for anything or nothing—stand good, on the principle of minus-pressure means unequalizing the pressure on the surface of the ocean and thereby promoting the ascent of the water. The sun and moon may be considered as intercepting or lessening the force of the general pressure on the sea, immediately beneath them respectively, which promotes the ascent of the water and the subsequent flow or tides.

In the phenomonon of the water-spout we have sensible proof of the ascent being promoted by minus-pressure means. From a cloud descends the spout, empty, funnel-shaped, and consisting of electric or elementary matter; as it approaches the sea, the water is forced upward towards and into it. That this arises from the elementary matter of which the spout consists, being a means of lessening the general pressure on the water whence the column took its rise, is as certain as that the barometric fluid is forced to ascend and continues elevated owing to the want of pressure on the top of the column; and as, that, were there no reduction of pressure, there would be no water, no quicksilver elevated.

Capillary ascent is erroneously attributed to attraction by the tube, but this is nothing short of "reason run riot:" inert bodies cannot attract any more than lifeless ones walk and talk, neither could the attraction of the tube be washed away or any way removed, yet, as, if the tube be "heated" or the water "hot" there is no capillary ascent, so neither is there any attraction in the case; the ascent is promoted by the electric matter within the tube, which matter intercepts the pressure above it from the water beneath it. This minus-pressure matter is, in design and service, as the torricellean vacuum above the quicksilver; and is removeable by fire, warm water and friction; cold water contributes to its increase.

Fire or flame placed over an immersed tube, promotes the ascent of the water within the tube; if the fire be removed the water falls; and the minus-pressure means consist in the elementary matter set free from the body in combustion at the top of the tube. It will be said the air is rarefied at top, well, be it so, still rarefied air is elementary matter, and as it prevents the water within the tube being under as great pressure as were it away, it is therefore, a true minus-pressure means. From the whole of these circumstances, it seems conclusive that matter in an elementary state lessens the general pressure on bodies.

Cause is the same in all cases; so are the means for bringing the cause into action; and by the same means which unequalises pressure on bodies, it is, that we are enabled to exist amidst a cause or medium of pressure, which, if unopposed by minus-pressure matter, would leave the earth an uninhabited mass. We live in a medium the pressure or force of which is productive of bodies of the tenacity of steel, yet so mixed is that part of it which immediately surrounds the globe with minus-pressure elementary matter, as reduces the pressure generally of the Atmosphere on the Earth to an average of fourteen pounds the square inch. So that were the atmosphere away, were that portion of the uniform medium in which the Earth is enveloped, which accompanies the earth, and to which is given the name Atmosphere, away, neither life nor vegetation could exist on the surface of the globe. And what is the atmosphere, this general minus-pressure means, but matter in the elementary state, such as contributes substance for the formation of all kinds of bodies, and into which the elementary substance of all manner of bodies is evolved, as decomposition proceeds.

On the common principles—pressure and minus-pressure means it is that a body becomes dissolved in a menstruum. A salt is dissolved in water, in consequence of the fluid presenting empty interstices to the atoms of the salt and from the atoms being forced out of the salt into those interstices by the centrifugal pressure of the Medium of Space within the salt. When simple water does not produce solution, the object is obtained by adding to it substances which shall originate in it such recipient interstices as correspond with the size of the atoms of the substance to be solved.

The last instance I shall advance in proof of pressure and minus-pressure means being cause and promoting means in all cases of motion, is that of continuous motion. *The truth of our philosophy depends* ALTOGETHER *on the discovery of the cause of continuous motion.*

All bodies contain minus-pressure matter which is removeable without injury to the texture of the body which has been for a time deprived of the same: and the body acquires again the like of that of which it had been deprived, from the medium, liquid or aeriform, in which it may be circumstanced.

The body—it may be repeated—which has minus-pressure matter equally on all parts, is pressed equally all round, and of consequence is in the state of rest; still it is under a less degree of pressure than were its minus-pressure matter away: and were the minus-pressure matter removed from one side only, the body from being under unequal pressure on opposite sides, will be pressed forward, that is, put in motion. To make an inert body be in motion, something must push or press it more on one side than on the opposite, by which it is under unequal pressure on opposite sides, and if free to be moved must be in motion. Hence it is evident that motion of a body is but the effect of the body being impulsively pressed more on one side than the opposite and thereby forced from out of its resting place through contiguous portions of space.

To put the body in a state so as it shall be pressed unequally on opposite sides, is the direct and sole object obtained by the sensible impulse given previously to projectile motion taking place. Let the first impelling cause be the hand, steam, condensed air set free, or exploded gun-powder, each tends to the same object, that of subverting the equilibrium of pressure on the body, without which being effected motion has no beginning.

The state of unequal pressure on the same body is obtained thuswise: the great velocity of the first impelling cause—of the hand in throwing a stone—carries or drives the projected body or stone as rapidly forward; and because the momentum the stone possesses is greater than that possessed by the minus-pressure matter in the rear of the body, this latter is left behind in the air, as would be dust from the rear, but not from the front of the body. The body or the stone retaining its minus-pressure matter in front while losing it from the rear, is under unequal pressure on opposite sides; the stronger pressure in the rear forces the body forward through the entire of its trajectory. And as the body during the entire of its motion is constantly *recovering* its natural quantity of lost minus-pressure matter, so is it as gradually becoming under less unequal pressure on opposite sides and of consequence its motion is equally on the decline. So when the rear of the body has acquired its full or natural quantity of minus-pressure matter—the pressure on the rear and front being thereby equalised—the body is no longer pressed forward and is of necessity at rest.

The fallacy of the theories of motion hitherto promulgated is evident. *Force is* not "*put into*" the projectile, nor is '*motion*,' neither of these being anything which one body parts with, which passes through the intermediate space, and which enters into another body; neither of the two, force or motion, is anything substantive. The force and motion of a body have never been, nor can ever become the force and motion of any other body. Neither of them is cause in the case, each is but the effect of the body being impelled. It is nonsense to say a body has acquired the force and motion of another body, or that it is moved by its own force or its own motion. Equally unreasonable is the notion, that a body continues in motion because it cannot stop itself. Suspend the systole of the heart, and although the blood cannot stop itself, yet where is the arterial flow. A comet cannot stop itself, but does it, *unimpelled*, "rush lawless through the sky." Has it innate motion? Can it have motion without an equal of cause? Again,—"Motion, *once impressed*, would cause a body to move for ever in empty space, because it cannot stop itself, owing to its inertia"— which is refuted by the dynamic axiom : *No effect can exceed its cause or be produced by less than its equal of cause.* Otherwise, motion, from impulse *once* impressed—or after impulse has ceased, is, either effect much greater than its cause or so much motion without cause or impulse, which is effect without any cause. In vacuo or empty space, from there being no impelling cause, there cannot, by any possibility, be motion. *Impulse is to motion as indispensable as air to animal existence.*

Now, without aiming at professional precision, it may be theoretically advanced, that the circulation depends on the blood acquiring minus-pressure matter at the expense of the air, in the lungs; which elementary matter, from being connected with the blood returned from the lungs to the heart, lessens the pressure on the parietes of the ventricle; and then by the greater pressure being on the outward surface of the heart it is, that the collapse or syst ole of this all-important organ is produced.

For of what use, it may be asked, except to unequalize pressure and thereby promote the motion of the blood, can the elementary matter be, which the air contributes and the blood acquires at every inspiration of the breath. It is not retained permanently by the blood, nor can it be said to combine with or be nutritive to the flesh, as its insensible transpiration through the body is obviously inferrible from its influx continuing the whole of life. It is not an air or gas—the membrane of the lungs being impervious to anything of the kind—but a pure and simple element, which adds no weight to the blood. It is that which when added to nitrogen converts it to atmospheric air; and which, when the quantity saturates the nitrogen, the resulting aeriform mixture is oxygen air; and hence it is that nitrogen is expired when oxygen is inspired. The heart, by the forcible collapse, sends the blood through the arteries and capillaries into the veins, the ascent; in which latter, there is reason for thinking, is promoted by what may be named mucillaginous minus-pressure means. The mucous lining of the veins, or rather minus-pressure contents, is as likely to be accessory to the ascent of the blood, as is oil of orange to that of water between two plates of glass. It is from the minus-pressure matter included in lint, cotton cloth and wick, sponge and hard sugar, that these bodies respectively. *promote* the ascent of water. A piece of cotton candlewick makes a good *filtering* syphon, with this singular advantage, it discharges from the *shorter* leg, all others from the longer. In each and every of these instances of ascent, there is evidently a minus-pressure means concerned: and if the mucous lining of the veins promote ascent of the blood, by causing this fluid to be under reduced pressure, we may well conceive that in like manner the slime on fishes is not uselessly formed, but may be designed to lessen the too great pressure these animals would be under at great depths of the sea.

Having, in the foregoing instances, exemplified the principles of the THEORY OF PRESSURE AND MINUS-PRESSURE MEANS, the whole, it will be found, are included in the following universal law.

WHEREVER THERE IS MOTION THE PRESSURE OF THE MEDIUM OF SPACE IS CAUSE: AND IN ALL CASES WHATEVER, MOTION IS PROMOTED IN CONSEQUENCE OF MINUS-PRESSURE MATTER SUBVERTING THE EQUILIBRIUM OF PRESSURE.

After the foregoing exposition of principles and facts—towards effecting the illustration of the answer to the previous question—*Wherein consists the Use of the Spleen?*—the question is almost self-answered, the case and solution being apparently inseparable, and really so to those who will take the trouble of studying the subject and make themselves acquainted with the Theory of Nature, which theory is rationally deducible from the Inertia of Matter. The answer to the foregoing question is: "The use of the spleen consists in promoting the rise or upward motion of the *diaphragm*."

The diaphragm is lifted up convexedly and afterwards depressed to its former level, which, by reducing and enlarging the capacity of the chest, makes this membrane, the diaphragm, the principal organ concerned in promoting respiration. The diaphragm is lifted by the cause of all motion, the pressure of the Medium of Space within our body in consequence of the equilibrium of pressure on it having been subverted: and the direction of motion indicates that the pressure is greater on the posterior than anterior surface. From which it is inferrible that the anterior surface has acquired minus-pressure matter from some contiguous organ, which organ is most probably the spleen. For as the blood within the spleen is made similar to venous and arterial blood alternately, and as it acquires and loses the respirable element intermittingly, which element the antĕrior or surface of the diaphragm should possess and lose intermittingly, to promote its motion upwards and downwards; together that hitherto no function whatever has been assigned the spleen, while its utility, in some way or other, cannot be denied; the inference therefore is, that the blood in the spleen is the medium of conveyance of minus-pressure elementary matter to the upper surface of the diaphragm, and for the purpose of *unequalising* the pressure on the opposite sides of the diaphragm; on which state of unequal pressure depends the elevation of this organ of respiration. So, when the depression of the diaphragm takes place, it is from the minus-pressure matter having escaped from its upper surface and the equilibrium of pressure having become restored in consequence. As the blood in the spleen acquires and loses the respirable element during each inspiration, it may be, that the diaphragm receives from the spleen the same element between every two inspirations, or, during the period of every expiration; and that this alternating order, in the receipt and transfer of minus-pressure elementary matter, is the means of occasioning the process of breathing to be intermitting.

I am aware of the opinion being entertained that the spleen is *seemingly* useless; yet all must allow there is not—there cannot be a universally superfluous or needless organ in the animal system.

Something must lessen occasionally the general pressure on the uppermost surface of the diaphragm: and to effect which, the diaphragm must be supplied with minus-pressure matter, to promote its motion. And although a diseased spleen may have been lessened or even wholly removed by decay or the knife, still it may be maintained, that, by the part to which the spleen *was* attached—by the orifices, as it were, of a vascular fleshy channel—the diaphragm may continue to receive—although imperfectly, or deficiently as to the healthome quantity—the vivifying element of the air; which latter is indispensable towards subverting the equilibrium of pressure on the opposite surfaces of the diaphragm. It may be remarked also, that, as when in perfect health we are compelled frequently to make a full or more lengthy inspiration, so, in thus *assisting the functions of the organ of respiration*, for the use of the diaphragm only, can the respirable element at such time inhaled and *for minus-pressure purposes*, be required.

All Nature has but one theory, yet the Faculty think that the laws evinced in the animal economy are different from those of physical nature. But are not the skeleton and fleshy organs, even the brain, physical? The mistake is discoverable at once by deducting all our sensations, which are so frequently imagined to be physical causes within the body; and then what remains but a sublime system of machinery, which, when inanimate or out. of motion, is resolveable into elementary matter, the like of that which is obtainable from bodies of every description when decomposed. It is imagined, also, that the pain felt at times is in the diseased part of the body; but let the nerves of the body be separated from the brain, and then the hand may be thrust into the fire without the smallest degree of pain being excited; pain, therefore, is not in the flesh or bones, but is confined to the sentient something named Mind. Another oversight of the Learned Faculty is their reasoning being confined to what are considered sensible, tangible, ponderable organs; to flesh, fluids, bones and cartileges; without once referring to the invisible agents—*not immaterial*—which, and although unnoticed by the sagacity of the greatly *book*-learned, are the sole *promoters* of the animal functions; and on which depend, *without being cause*—in any instance—all the motions of the organs which belong to the animal system.

Gout and rheumatic affections may be accounted for on the principles and theory of minus-pressure means.

The nervous fluid conists most probably in a portion of the Medium of Space within each of the nerves. For, as there must be a connecting link between the brain and most distant body in every case of *visual* sense excitement, in order that the remote body or object shall act, at least mediately, on the brain; so, the Medium of Space only is that which can be continuous from the brain through the optic nerve, thence through the Atmosphere, thence through the regions of space to this or that one of the known fixt stars, said to be looked and seen. Hence to protect the brain against extremes of pressure by this medium, which extremes would keep the mind in a state of endless torture, it is conceivable, that a minus-pressure means, either simply elementary, or as a mucillagenous covering, surrounds the nerves: or, it may be that for such purpose minus-pressure elementary matter is intermixed with the nervous fluid, the Medium of Space within the tubulously structured nerves. But whatever may be the fact, it is inferrible from the pains apparently in the limbs, at other times flying apparently from limb to limb, that this is owing to the minus-pressure matter within, or exteriorly coating the nerves, being reduced from its natural quantity; or, as would be said of a film or web, rent here and there, by which the Medium of Space within the nerves is made liable to be so acted on, as to have its pressure on the brain suddenly altered at every constitutional change to which the body is subject and the brain, in consequence, to be more or less lacerated in every instance, by which are originated in the mind those torturing sensations named pains of rheumatism and pains of gout.

It may here be noticed the many self-acting qualities and properties erroneously attributed to muscular fibrine. But as every mechanical performance has its mechanical motive power, independent of the machinery, so is the pressure of the medium of space from without to within a muscle, the acting cause in producing all muscular motion. Flesh is neither sensible nor irritable; nor of itself can a muscle contract or expand.

The following is a crude illustration of the offices of the diaphragm and spleen. A handkerchief held horizontally is under equal pressure on both sides, for if not it would be pressed out of that position. Supposing then the pressure to be lessened on the anterior surface by throwing smoke on it, the unaltered pressure beneath would raise the flexible plane upwards, diaphragm-like. Then, as the smoke vanishes and the pressure in consequence becomes equal on both sides, the convexity subsides and the former horizontal position becomes restored. The diaphragm receives minus-pressure matter on its anterior surface from the blood of the spleen: the spleen acquires the like from the air during respiration; and this elementary matter has no other use in the system than that of promoting the motion of the organs which first receive it and from which, in due order, it should be transferred for the purpose of subverting the equilibrium of pressure which is productive of motion.

Should the foregoing be found to correspond with the natural fact, I admit that it may be considered less in the light of a discovery, than a consequence of the correctness of the THEORY OF PRESSURE AND MINUS-PRESSURE deduced from the principal INERTIA. For which Theory complete, see Note, page 8.

ERRATA.—In page 26, 12th line, after the word gunpowder, read "the impulse by." In the 22d line of the 32d page, for "together that hitherto," read "together with the circumstance, that hitherto."

BROUGHAM COTTAGE, JERSEY,
20th July, 1839.

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